



# Stormwater Management Report

**Sunnycrest Circle  
Residential Subdivision**

**11-15 Sunnycrest Avenue  
Beverly, MA**

January 7 2016

Applicant:  
PD Building, LLC

Submitted to:  
City of Beverly Conservation  
Commission



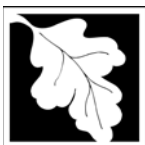
Prepared by:  
Griffin Engineering  
Beverly, MA

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STORMWATER  
MANAGEMENT  
CHECKLIST



# Checklist for Stormwater Report

## A. Introduction

**Important:** When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the [Massachusetts Stormwater Handbook](#). The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.<sup>1</sup> This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8<sup>2</sup>
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification

<sup>1</sup> The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

<sup>2</sup> For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

## B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide



Massachusetts Department of Environmental Protection  
Bureau of Resource Protection - Wetlands Program

# Checklist for Stormwater Report

conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

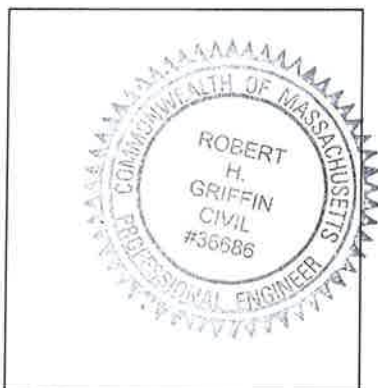
*Note:* Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

## Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



1-4-16

Signature and Date

## Checklist

**Project Type:** Is the application for new development, redevelopment, or a mix of new and redevelopment?

- ☐ New development
- ☐ Redevelopment
- ☒ Mix of New Development and Redevelopment

## Checklist (continued)

**LID Measures:** Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of



# Checklist for Stormwater Report

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the project:

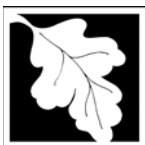
- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☒ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): \_\_\_\_\_

## Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

## Checklist (continued)

### Standard 2: Peak Rate Attenuation



# Checklist for Stormwater Report

- ☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- ☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- ☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

## Standard 3: Recharge

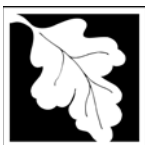
- ☒ Soil Analysis provided.
- ☒ Required Recharge Volume calculation provided.
- ☐ Required Recharge volume reduced through use of the LID site Design Credits.
- ☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.
  - ☒ Static
  - ☐ Simple Dynamic
  - ☐ Dynamic Field<sup>1</sup>
- ☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.
- ☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- ☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- ☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
  - ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
  - ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
  - ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
  - ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- ☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- ☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

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<sup>1</sup> 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

## Checklist (continued)

### Standard 3: Recharge (continued)



# Checklist for Stormwater Report

- ☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- ☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

## Standard 4: Water Quality

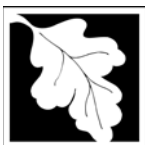
The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
  - Provisions for storing materials and waste products inside or under cover;
  - Vehicle washing controls;
  - Requirements for routine inspections and maintenance of stormwater BMPs;
  - Spill prevention and response plans;
  - Provisions for maintenance of lawns, gardens, and other landscaped areas;
  - Requirements for storage and use of fertilizers, herbicides, and pesticides;
  - Pet waste management provisions;
  - Provisions for operation and management of septic systems;
  - Provisions for solid waste management;
  - Snow disposal and plowing plans relative to Wetland Resource Areas;
  - Winter Road Salt and/or Sand Use and Storage restrictions;
  - Street sweeping schedules;
  - Provisions for prevention of illicit discharges to the stormwater management system;
  - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
  - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
  - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- ☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
- ☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
- ☐ is within the Zone II or Interim Wellhead Protection Area
  - ☐ is near or to other critical areas
  - ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
  - ☐ involves runoff from land uses with higher potential pollutant loads.
- ☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.
- ☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

## Checklist (continued)

### Standard 4: Water Quality (continued)





# Checklist for Stormwater Report

- ☒ The BMP is sized (and calculations provided) based on:
  - ☒ The ½" or 1" Water Quality Volume or
  - ☒ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- ☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the proprietary BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- ☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

## Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

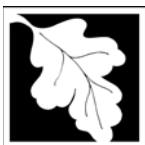
- ☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- ☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- ☐ The NPDES Multi-Sector General Permit does **not** cover the land use.
- ☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- ☐ All exposure has been eliminated.
- ☐ All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- ☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

## Standard 6: Critical Areas

- ☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- ☐ Critical areas and BMPs are identified in the Stormwater Report.

## Checklist (continued)

### Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable



# Checklist for Stormwater Report

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- ☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
- ☐ Limited Project
  - ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
  - ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
  - ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
  - ☐ Bike Path and/or Foot Path
  - ☐ Redevelopment Project
  - ☒ Redevelopment portion of mix of new and redevelopment.
- ☒ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- ☒ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

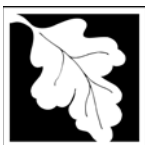
## Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
  - Construction Period Operation and Maintenance Plan;
  - Names of Persons or Entity Responsible for Plan Compliance;
  - Construction Period Pollution Prevention Measures;
  - Erosion and Sedimentation Control Plan Drawings;
  - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
  - Vegetation Planning;
  - Site Development Plan;
  - Construction Sequencing Plan;
  - Sequencing of Erosion and Sedimentation Controls;
  - Operation and Maintenance of Erosion and Sedimentation Controls;
  - Inspection Schedule;
  - Maintenance Schedule;
  - Inspection and Maintenance Log Form.
- ☐ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

## Checklist (continued)

### Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)



# Checklist for Stormwater Report

- ☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- ☐ The project is **not** covered by a NPDES Construction General Permit.
- ☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- ☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

## Standard 9: Operation and Maintenance Plan

- ☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
  - ☒ Name of the stormwater management system owners;
  - ☒ Party responsible for operation and maintenance;
  - ☒ Schedule for implementation of routine and non-routine maintenance tasks;
  - ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
  - ☒ Description and delineation of public safety features;
  - ☐ Estimated operation and maintenance budget; and
  - ☒ Operation and Maintenance Log Form.
- ☐ The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
  - ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
  - ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

## Standard 10: Prohibition of Illicit Discharges

- ☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- ☐ An Illicit Discharge Compliance Statement is attached;
- ☒ NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

ATTACHMENT A

PROJECT  
DESCRIPTION

## **1.0 INTRODUCTION**

This stormwater management report is prepared in support of the proposed residential development at 11-15 Sunnycrest Avenue in Beverly, MA. The project consists of removing a two-family residence and constructing a new 155-foot long dead end roadway with six new single-family residences. The existing residence at 11 Sunnycrest Avenue is to remain.

According to the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management regulations, the proposed construction is exempt from MassDEP Stormwater Management requirements since the proposed development is outside of the jurisdictional 100-foot Buffer Zone to a wetland resource area. However, the regulations establish a framework for evaluating stormwater management systems that is used by the City of Beverly in evaluating new development projects. The narrative below compares the proposed construction to the MassDEP Stormwater Management requirements. The proposed drainage system is in full compliance with those standards as they apply to this combination redevelopment / new development project.

### **1.1 Existing Conditions**

The project site consists of three properties totaling approximately 6.10-acres. Two properties are developed with residences and associated driveways, utilities, and landscaping. The third property is a large vacant parcel consisting of woodlands and scrub vegetation. The project site is predominately surrounded by single-family residential properties with Sunnycrest and Netherton Avenue to the northeast and a narrow connection to Hayes Avenue to the south. The topography of the site consists of sloping terrain. The majority of the site drains to a wetland resource area on the southerly portion of the project site.

### **1.2 Proposed Conditions**

The proposed project involves razing the existing two-family residence at 15 Sunnycrest Avenue and constructing a dead-end roadway with six new single-family residences. The residence at 11 Sunnycrest Avenue is to remain. The proposed roadway, Sunnycrest Circle, is 155-feet long to the center of the cul-de-sac and contains the necessary municipal utility services and a modern drainage system. The proposed single-family residences consist of modest sized dwellings with associated driveways, utilities, drywell infiltration structures and landscaping. A site plan showing the proposed development and stormwater management features have been separately provided.

The proposed project is a mixture of new development and redevelopment. When

complete, there will be an increase of approximately 25,390 square feet of impervious surfaces at the site. The proposed stormwater managements system is designed to fully meet all stormwater management standards for the proposed impervious surfaces.

## **2.0 STORMWATER MANAGEMENT STANDARDS**

### **2.1 Standard 1: No New Untreated Discharges**

There is one new drainage outfall associated with the proposed project. Stormwater conveyed to the new outfall will be treated by deep sump catchbasins, a First Defense proprietary separator pretreatment device, and an infiltration basin prior to discharge. The annual average TSS removal for the system was estimated to be 85%.

The drainage outfall contains a 10-foot wide level spreader device to disperse stormwater leaving the infiltration basin. Level spreader and rip-rap sizing calculations are provided in Attachment B.1.

### **2.2 Standard 2: Peak Rate Attenuation**

Hydrologic modeling was conducted using a HydroCAD computer model. This model uses an approximation of Soil Conservation Service TR-20 methods to calculate runoff rates and volumes based on descriptions of land use, ground characteristics, and size.

The time of concentration ( $T_c$ ) for each subcatchment was calculated in HydroCAD using a combination of sheet flow and shallow concentrated flow. Sheet flow uses roughness coefficients (Manning's  $n$ ) and watercourse slope to calculate travel time of stormwater runoff for each subcatchment. The site was modeled using a maximum of 100-feet of sheet flow. The shallow concentrated flow method was used to determine the velocity factor along the flow path of the runoff and thereby derive a travel time. The time of concentration of each subcatchment is the combination of these travel times. A minimum time of concentration of 6 minutes was used for all subcatchments, for both existing and proposed conditions.

Stormwater from the proposed development discharges in three main directions; 1) northerly towards residential properties along Bridge Street, Virginia Avenue and Sunnycrest Avenue; 2) westerly towards residential properties along Kennedy Drive, and 3) southerly towards an onsite wetland resource area.

The enclosed drainage calculations indicate that there is a decrease in the post-development peak runoff rates for the 2-, 10-, 25-, and 100-year, 24-hour storm events (the HydroCAD drainage calculations for the aforementioned storm events are provided in Attachment C). Comparison of pre- and post-development stormwater runoff calculation results are summarized below in Table 1 thru 3 for the three main discharge directions.

**Table 1 : Comparison of Pre-Development and  
Post Development Peak Runoff Rates (cfs)  
Towards the North (Bridge Street, Virginia  
Avenue, & Sunnycrest Avenue)**

<u>Subcatchment</u>	Storm Frequency			
	2-Year	10-Year	25-Year	100-Year
Pre-Development	0.83	1.79	2.46	3.32
Post-Development	0.71	1.48	2.02	2.70

**Table 2 : Comparison of Pre-Development and  
Post Development Peak Runoff Rates (cfs)  
Towards the West (Kennedy Drive)**

<u>Subcatchment</u>	Storm Frequency			
	2-Year	10-Year	25-Year	100-Year
Pre-Development	0.36	0.83	1.18	1.62
Post-Development	0.36	0.82	1.15	1.57

**Table 3 : Comparison of Pre-Development and  
Post Development Peak Runoff Rates (cfs)  
Towards the South (On-site Wetland)**

<u>Subcatchment</u>	Storm Frequency			
	2-Year	10-Year	25-Year	100-Year
Pre-Development	1.30	3.02	4.27	5.87
Post-Development	0.87	1.98	2.78	3.80

The enclosed drainage calculations also indicate that there is a slight decrease in the post-development peak runoff volumes for the 2-, 10-, 25-, and 100-year, 24-hour storm events. Comparison of pre- and post-development stormwater runoff volume calculation results are summarized below in Table 4 thru 6 for the three main discharge directions.

**Table 4 : Comparison of Pre-Development and Post Development Peak Runoff Volume (cf) Towards the North (Bridge Street, Virginia Avenue, & Sunnycrest Avenue**

<u>Subcatchment</u>	Storm Frequency			
	2-Year	10-Year	25-Year	100-Year
Pre-Development	3,776	7,659	10,435	14,017
Post-Development	2,431	4,898	7,032	9,969

**Table 5 : Comparison of Pre-Development and Post Development Peak Runoff Volume (cf) Towards the West (Kennedy Drive)**

<u>Subcatchment</u>	Storm Frequency			
	2-Year	10-Year	25-Year	100-Year
Pre-Development	1,766	3,767	5,227	7,133
Post-Development	1,368	2,869	3,956	5,429

**Table 6 : Comparison of Pre-Development and Post Development Peak Runoff Volume (cf) Towards the South (On-site Wetland)**

<u>Subcatchment</u>	Storm Frequency			
	2-Year	10-Year	25-Year	100-Year
Pre-Development	6,011	12,823	17,794	24,280
Post-Development	5,692	12,328	17,281	24,172

### **2.3 Standard 3: Recharge**

Site soils are mapped by the United States Department of Agriculture – Soil Conservation Service (Essex Co. Massachusetts Southern Part Soil Survey, 1984) as being Chatfield-Hollis-Rock Outcrop. Based upon observed site conditions and test pits performed on November 19, 2015, a 'C' hydrologic soil group was assigned to the Chatfield-Hollis-Rock Outcrop soils for this analysis.



For C-type soils, the Stormwater Management Guidelines require that a recharge device be provided with a capacity equal to 0.25-inches times the impervious area. The post-development impervious surfaces are approximately 32,890 sf, which yields a minimum design groundwater recharge volume of approximately 685 cf.

The infiltration devices selected for this project consist of one drywell on each building lot and an infiltration basin to predominately serve the proposed roadway. The total static recharge capacity of the infiltration devices is approximately 2,821 cf (volume measured below the relief outlets). This substantially exceeds the minimum volume required for this project. Supporting calculations are provided in Attachment B.2.

As noted above, test pits were performed to analyze the subsurface soil conditions at the project site and assign an exfiltration rate. The native soils are characterized as sandy-loam. Therefore, the applicable Rawls Rate used for the drawdown calculations of the stormwater infiltration devices is 1.02 inches per hour. At this rate, the proposed drywells will drawdown in approximately 53 hours and the infiltration basin will drawdown in approximately 15 hours. This is in compliance with the maximum 72-hours allowed by MassDEP Stormwater Management Regulations. Drawdown calculations and test pit field data forms are provided in Attachment B.3 and B.4, respectively.

#### **2.4 Standard 4: Water Quality**

The minimum required water quality treatment volume for the proposed residential development is the first one-half inch of runoff from the impervious surfaces. The reader is referred to Water Quality Volume Calculations, Structural BMP Sizing Calculations, and TSS Removal Worksheets provided in Attachments B.5 thru B.7.

Stormwater runoff from the proposed building roofs that drain to the north (Bridge Street, Sunnycrest Avenue, & Virginia Avenue) and west (Kennedy Drive) will be treated by drywell infiltration structures which have an 80% TSS removal rate per the MassDEP stormwater management guidelines. The remaining proposed impervious surfaces will drain towards the southerly wetland resource area which is treated by deep-sump catchbasins, a First Defense proprietary separator, and an infiltration basin. This treatment train has a minimum 85% TSS removal rate. Although the First Defense proprietary treatment device has an 83% TSS removal rate (per the manufacturer) this benefit is largely ignored in the system-wide TSS removal calculation since the device is considered a pretreatment component for the infiltration basin terminal treatment device. MassDEP assigns a maximum 80% TSS removal rate for the combined pretreatment device and infiltration basin. First Defense proprietary treatment device sizing calculations are provided in Attachment B.6.

A small portion of the impervious surfaces tributary to the proposed infiltration basin is not captured by the street drainage system and will sheet flow into the pond via a

densely vegetated filter strip (i.e. lawn) resulting in an 80% TSS removal rate. There is also a small (approx. 40 sf) area of the proposed roadway entrance that goes largely untreated and will bypass the proposed infiltration basin. This small area is considered 'de minimus' per the Stormwater Management Regulations. Capturing runoff from this area is not possible due to topographic constraints.

Capturing and treating stormwater runoff from the existing 11 Sunnycrest Avenue driveway and front portion of the building roof is also not practicable and is not required. These areas are existing impervious surfaces that are subject to the stormwater management standards to the maximum extent practicable (Standard 7: Redevelopment). A further discussion of Standard 7 is provided below.

As required by the Stormwater Management Standards, a Long-Term Pollution Prevention Plan has been prepared and can be found in Attachment E. In short, the plan identifies suitable practices for source control and pollution prevention measures.

## **2.5 Standard 5: Land Uses with Higher Potential Pollutant Loads**

In accordance with the Stormwater Management Standards, the proposed residential use is not considered a Land Use with Higher Potential Pollutant Loads. Therefore, this standard does not apply to this project.

## **2.6 Standard 6: Critical Areas**

The project site is not tributary to an environmentally-critical area as defined by the Stormwater Management Standards. Therefore, this standard does not apply to this project.

## **2.7 Standard 7: Redevelopment and Other Projects Subject to the Standards only to the Maximum Extent Practicable**

The project meets all standards for new development except for a small portion of the existing developed property at 11 Sunnycrest Avenue. As noted above, TSS removal is not provided for the existing driveway and front portion of the existing residence. It is not possible to capture and convey stormwater from these existing areas into the proposed drainage system for treatment due to their location and topography. Stormwater runoff from these areas currently drains towards the existing street drainage system and will continue to do so.

## **2.8 Standard 8: Construction Period Pollution Prevention and Erosion and Sediment Control**

Consistent with the NPDES Construction General Permit requirements, a Stormwater Pollution Prevention Plan (SWPPP) is to be prepared for any project resulting in over 1-acre of land. The proposed project will disturb approximately 2-acres of land. In accordance with the Massachusetts Stormwater Management Standards and the

General Permit, a SWPPP will be prepared prior to land disturbance commencing. A copy will be provided to the City upon request.

## **2.9 Standard 9: Operation and Maintenance Plan**

An Operations & Maintenance plan has been provided in Attachment F. The owner(s) of the residences are the parties responsible for drywell operation and maintenance; and the City, after acceptance of the road, will be the party responsible for the roadway drainage system, including the infiltration basin operation and maintenance.

## **2.10 Standard 10: Illicit Discharges**

The submitted Long-Term Pollution Prevention Plan (Attachment D) specifies measures to prevent illicit discharges from entering the stormwater management system. Source control and response plans are also specified to prevent illicit discharges from being conveyed through the stormwater management system.

Consistent with the Massachusetts Stormwater Handbook, a signed Illicit Discharge Compliance Statement prior to discharging stormwater to the post-construction stormwater BMP's. A draft copy of the Illicit Discharge Statement is provided in attachment G.

## **3.0 SUMMARY**

The proposed drainage system and site development plans for the seven-lot residential subdivision conforms to the MassDEP Stormwater Management Regulations. The proposed drainage system will treat and remove TSS and other pollutants throughout the project area, recharge groundwater, and minimize erosion. Proper construction and operation and maintenance of the proposed drainage system are critical to its long-term performance. To that end, an Operations and Maintenance Plan and Long-Term Pollution Prevention Plan have been prepared and will be instituted.

ATTACHMENT B

STORMWATER  
COMPUTATIONS

- B.1) Rip Rap Discharge Design Calculations
- B.2) Recharge Volume & Design Calculations
- B.3) Drawdown Analysis
- B.4) Soil Test Pit Data
- B.5) Water Quality Volume Calculation
- B.6) Structural BMP's Sizing Calculations
- B.7) TSS Removal Calculation Worksheet



## RIP RAP DISCHARGE DESIGN CALCULATIONS

Job Name: Sunnycrest Circle  
Job No: 1514  
Date: 1/7/2016  
Designer: J. Blanchette, PE  
Checked By: R. Griffin, PE

### BROAD-CRESTED WEIR CALCULATION FOR LEVEL SPREADER

Equation  $H = (Q/CL)^{2/3}$   
H = Head Above Crest (ft)  
Q = Discharge (cfs)  
C = Weir Coefficient  
L = Weir Length (ft)

Input: Q = 0.92 (100-Year Storm; Ignoring Exfiltration)  
C = 3  
L = 17  
Output: H = 0.07 ft

Area = L x H = 1.2 sf

Velocity = Q/Area = 0.8 ft/sec

**Allowable Velocity for Mulch Ground Cover is 1 to 2 ft/sec. -> OK**

### STONE SIZE

Equation  $d50 = Do \times 0.020 \times (Do/TW) \times (Q/Do^{2.5})^{1.33}$   
d50 = Diameter of average Stone Size (ft)  
Do = Pipe diameter (ft)  
TW = Tailwater depth (ft)  
Q = Pipe discharge (cfs)

Do = 1 ft  
TW = 0.22 ft  
Q = 0.92 cfs  
d50 = 0.08 ft  
1.0 in

**Use Min. 6"**

Max. Stone Size = 1.5 x d50 = 9 in  
Min. Thickness = 1.5 x Max = 13.5 in



## RECHARGE VOLUME & DESIGN CALCULATIONS

Job Name: Sunnycrest Circle  
Job No: 1514  
Date: 1/7/2016  
Designer: J. Blanchette, PE  
Checked By: R. Griffin, PE

### IMPERVIOUS AREAS

	Total
Existing	7,500
Proposed	32,890
Net Increase	25,390

Target Depth Factor:

"C" Type Soils

0.25 inches of runoff

### MINIMUM RECHARGE REQUIRED:

For Increase in Impervious Area:

$$\text{Volume} = (25,390 \text{ sf}) \times (0.25") \times (1'/12") = 529 \text{ cf}$$

For all Impervious Surfaces:

$$\text{Volume} = (32,890 \text{ sf}) \times (0.25") \times (1'/12") = 685 \text{ cf} *$$

*\*Standard to be met for all Impervious Surfaces*

### DRYWELLS

Impervious Area Tributary to Drywells = 6,060 sf

(Subcatchment P-1a, 1c, 2a, 3a & 3b)

Minimum Volume Req'd (0.25") = 126 cf

Storage Volume Per 1,000 gal. Drywell\* 134 (Static Vol., Ignoring Stone)

Provided Recharge Volume (6 Drywells) 1320 cf -> **OK**

*\*Reference HydroCAD Calcs*

### INFILTRATION BASIN

Impervious Area Tributary to Infil. Basin = 23,724 sf

(Subcatchment P-1a, 1c, 2a, 3a & 3b)

Minimum Volume Req'd (0.25") = 494 cf

Provided Recharge Volume Below Bottom Orifice\* 1501 cf -> **OK**

*\*See Calc Below*

TOTAL RECHARGE PROVIDE

1320 cf + 1501 cf = 2821 cf

Basin Static Volume Below Bottom Orifice

Area of Basin At Bottom (El. 58.0) = 914

Area of Basin At Next Contour (El. 60.0) = 1834

Elevation of Bottom Orifice = 59.25

Pond Area at Bottom Orifice =

$$= 914 + (1834-914)/2 \times (59.25-58.0) = 1489 \text{ sf}$$

Pond Volume Below Orifice =

$$= (914+1489)/2 \times (59.25-58.0) = 1501 \text{ cf}$$



**Griffin Engineering Group, LLC**  
**495 Cabot Street, 2nd Floor**  
**Beverly, MA 01915**

**Phone: 978-927-5111; Fax: 978-927-5103**

---

## **DRAWDOWN ANALYSIS**

Job Name: Sunnycrest Circle  
Job No: 1514  
Date: 1/7/2016  
Designer: J. Blanchette, PE  
Checked By: R. Griffin, PE

### **DRAWDOWN CALCULATION:**

Equation:  $\text{Drawdown} = D / \text{IR (hrs)}$   
D = Depth of Water in Structure (in)  
IR = Infiltration Rate\* (in/hr)

	D	IR*	Drawdown
Drywells	54	1.02	<b>52.9</b>
Infiltration Field	15.00	1.02	<b>14.7</b>

\* Rawls Rate for Sandy Loam Used

MassDEP requires drawdown to be less than 72 hours ->

**OK**



**Location Address** 11-15 Sunnycrest Ave, Beverly, MA 01915

**On-site Review**

**Deep Hole Number:** 1 **Date:** 11/19/2015 **Time:** 9:30 **Weather:** 40° Cloudy

**Location:** (identify of site plan) **Ground Elevation at Surface of Hole:** 58.7'

**Land Use:** Woodland **Surface Stones:** Boulder Walls, Outcrop

**Vegetation:** Scrub Vegetation **Landform:** Ground Moraine with Bedrock Outcrop

**Slope(%):** 15%

**Distance from:**

Open Water Body	<u>NA</u> feet	Drainage Way	<u>NA</u> feet
Possible Wet Area	<u>200</u> feet	Property Line	<u>70</u> feet
Drinking Water Well	<u>NA</u> feet	Other	<u></u>

**DEEP OBSERVATION HOLE LOG**

Depth from Surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Kind & Grade, Consistency, % Gravel, Stones, Boulders .....)
0-10	Ap	FSL	10YR 3/2		Crumble, Friable, Trace Gravel
10-16	Bw	FSL	10YR 4/6		Massive, Friable, Trace Gravel
16-38	C1	SL	10YR 6/6		Massive, Friable, Some Gravel
38-65	C2	SL	2.5Y 6/6	5YR 4/4 @ 40"	Very Dense, Gravelly, Compact
No Refusal					
					Roots to 38"

**Parent Material (geologic):** Glacial Till **Depth of Bedrock:** NA

**Groundwater Observed:** No If Yes: Depth of Weeping from Pit:

Depth Standing Water in Hole: N/A inches

Estimated Seasonal High Groundwater: 55.4 feet 40"

**Does at least 4-ft of naturally occurring pervious material exist:** NA

Upper Boundary (inches) : NA Lower Boundary (inches): NA

**Certification**

I certify that on NA I have passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise, and experience des

Signature

Date

**DEP APPROVED FORM - 12/07/95**

**Location Address** 11-15 Sunnycrest Ave, Beverly, MA 01915

On-site Review

**Deep Hole Number:** 2 **Date:** 11/19/2015 **Time:** 9:45 **Weather:** 40° Cloudy

**Location:** (identify of site plan) **Ground Elevation at Surface of Hole:** 58.3'

**Land Use:** Woodland **Surface Stones:** Boulder Walls, Outcrop

**Vegetation:** Scrub Vegetation **Landform:** Ground Moraine with Bedrock Outcrop

**Slope(%):** 13%

**Distance from:**

Open Water Body	<u>NA</u> feet	Drainage Way	<u>NA</u> feet
Possible Wet Area	<u>150</u> feet	Property Line	<u>90</u> feet
Drinking Water Well	<u>NA</u> feet	Other	<u></u>

**DEEP OBSERVATION HOLE LOG**

Depth from Surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Kind & Grade, Consistency, % Gravel, Stones, Boulders .....)
0-8	Ap	FSL	10YR 3/2		Crumble, Friable, Trace Gravel
8-20	Bw	FSL	10YR 4/6		Massive, Friable, Trace Gravel
20-33	C1	SL	10YR 6/6		Massive, Friable, Some Gravel
33-42	C2	SL	2.5Y 6/6	5YR 4/4 @ 33"	Very Dense, Gravelly, Compact
Refusal					
					Roots to 33"

**Parent Material (geologic):** Glacial Till **Depth of Bedrock:** 33"

**Groundwater Observed:** No If Yes: Depth of Weeping from Pit:

Depth Standing Water in Hole: N/A inches

Estimated Seasonal High Groundwater: 55.6 feet 33"

**Does at least 4-ft of naturally occurring pervious material exist:** NA

Upper Boundary (inches) : NA Lower Boundary (inches): NA

Certification

I certify that on NA I have passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise, and experience des

Signature

Date

**DEP APPROVED FORM - 12/07/95**

**Location Address** 11-15 Sunnycrest Ave, Beverly, MA 01915

**On-site Review**

**Deep Hole Number:** 3 **Date:** 11/19/2015 **Time:** 10:00 **Weather:** 40° Cloudy

**Location:** (identify of site plan) **Ground Elevation at Surface of Hole:** 71.8'

**Land Use:** Woodland **Surface Stones:** Boulder Walls, Outcrop

**Vegetation:** Scrub Vegetation **Landform:** Ground Moraine with Bedrock Outcrop

**Slope(%):** 10%

**Distance from:**

Open Water Body	<u>NA</u> feet	Drainage Way	<u>NA</u> feet
Possible Wet Area	<u>238</u> feet	Property Line	<u>50</u> feet
Drinking Water Well	<u>NA</u> feet	Other	<u></u>

**DEEP OBSERVATION HOLE LOG**

Depth from Surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Kind & Grade, Consistency, % Gravel, Stones, Boulders .....)
0-8	Ap	FSL	10YR 3/2		Crumble, Friable, Trace Gravel
8-16	Bw	FSL	10YR 4/6		Massive, Friable, Trace Gravel
16-32	C1	SL	10YR 6/6		Massive, Friable, Some Gravel
32-72	C2	SL/LS	2.5Y 6/6	5YR 4/4 @ 42"	Dense, Very Gravelly
No Refusal					
					Roots to 72"

**Parent Material (geologic):** Glacial Till **Depth of Bedrock:** N/A

**Groundwater Observed:** No If Yes: Depth of Weeping from Pit:

Depth Standing Water in Hole: N/A inches

Estimated Seasonal High Groundwater: 68.3 feet 42"

**Does at least 4-ft of naturally occurring pervious material exist:** NA

Upper Boundary (inches) : NA Lower Boundary (inches): NA

**Certification**

I certify that on NA I have passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise, and experience des

Signature

Date

**DEP APPROVED FORM - 12/07/95**

**Location Address**11-15 Sunnycrest Ave, Beverly, MA 01915**On-site Review****Deep Hole Number:** 4 **Date:** 11/19/2015 **Time:** 10:30 **Weather:** 40° Cloudy**Location:** (identify of site plan) **Ground Elevation at Surface of Hole:** 68.0'**Land Use:** Woodland **Surface Stones:** Boulder Walls, Outcrop**Vegetation:** Scrub Vegetation **Landform:** Ground Moraine with Bedrock Outcrop**Slope(%):** 15%**Distance from:**

Open Water Body	<u>NA</u> feet	Drainage Way	<u>NA</u> feet
Possible Wet Area	<u>165</u> feet	Property Line	<u>125</u> feet
Drinking Water Well	<u>NA</u> feet	Other	<u></u>

**DEEP OBSERVATION HOLE LOG**

Depth from Surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Kind & Grade, Consistency, % Gravel, Stones, Boulders .....)
0-10	Ap	FSL	10YR 3/2		Crumble, Friable, Trace Gravel
10-24	Bw	FSL	10YR 4/6		Massive, Friable, Trace Gravel
24-50	C1	SL	10YR 6/6		Massive, Friable, Some Gravel
50-60	C2	SL	2.5Y 6/6	5YR 4/4 @ 50"	Very Dense, Gravelly, Compact
No Refusal					
					Roots to 50"

**Parent Material (geologic):** Glacial Till **Depth of Bedrock:** N/A**Groundwater Observed:** No If Yes: Depth of Weeping from Pit: Depth Standing Water in Hole: N/A inchesEstimated Seasonal High Groundwater: 63.8 feet 50"**Does at least 4-ft of naturally occurring pervious material exist:** NAUpper Boundary (inches) : NA Lower Boundary (inches): NA**Certification**

I certify that on NA I have passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise, and experience des

Signature Date **DEP APPROVED FORM - 12/07/95**

**Location Address** 11-15 Sunnycrest Ave, Beverly, MA 01915

On-site Review

**Deep Hole Number:** 5 **Date:** 11/19/2015 **Time:** 11:00 **Weather:** 40° Cloudy

**Location:** (identify of site plan) **Ground Elevation at Surface of Hole:** 77.1'

**Land Use:** Woodland **Surface Stones:** Boulder Walls, Outcrop

**Vegetation:** Scrub Vegetation **Landform:** Ground Moraine with Bedrock Outcrop

**Slope(%):** 10%

**Distance from:**

Open Water Body	<u>NA</u> feet	Drainage Way	<u>NA</u> feet
Possible Wet Area	<u>&gt;100</u> feet	Property Line	<u>40</u> feet
Drinking Water Well	<u>NA</u> feet	Other	<u></u>

**DEEP OBSERVATION HOLE LOG**

Depth from Surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Kind & Grade, Consistency, % Gravel, Stones, Boulders .....)
0-8	Ap	FSL	10YR 3/2		Crumble, Friable, Trace Gravel
8-16	Bw	FSL	10YR 4/6		Massive, Friable, Trace Gravel
16-28	C1	SL	2.5Y 4/6		Massive, Friable, Some Gravel
Refusal					
					Roots to 28"

**Parent Material (geologic):** Glacial Till **Depth of Bedrock:** N/A

**Groundwater Observed:** No If Yes: Depth of Weeping from Pit:

Depth Standing Water in Hole: N/A inches

Estimated Seasonal High Groundwater: 74.8 feet 28"

**Does at least 4-ft of naturally occurring pervious material exist:** NA

Upper Boundary (inches) : NA Lower Boundary (inches): NA

Certification

I certify that on NA I have passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise, and experience des

Signature

Date

**DEP APPROVED FORM - 12/07/95**

**Location Address** 11-15 Sunnycrest Ave, Beverly, MA 01915

**On-site Review**

**Deep Hole Number:** 6 **Date:** 11/19/2015 **Time:** 11:15 **Weather:** 40° Cloudy

**Location:** (identify of site plan) **Ground Elevation at Surface of Hole:** 75.9'

**Land Use:** Woodland **Surface Stones:** Boulder Walls, Outcrop

**Vegetation:** Scrub Vegetation **Landform:** Ground Moraine with Bedrock Outcrop

**Slope(%):** 14%

**Distance from:**

Open Water Body	<u>NA</u> feet	Drainage Way	<u>NA</u> feet
Possible Wet Area	<u>&gt;100</u> feet	Property Line	<u>62</u> feet
Drinking Water Well	<u>NA</u> feet	Other	<u></u>

**DEEP OBSERVATION HOLE LOG**

Depth from Surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Kind & Grade, Consistency, % Gravel, Stones, Boulders .....)
0-8	Ap	FSL	10YR 3/2		Crumble, Friable, Trace Gravel
8-16	Bw	FSL	10YR 4/6		Massive, Friable, Trace Gravel
16-30	C1	SL	2.5Y 4/6		Massive, Friable, Some Gravel
30-42	CD	SL	2.5Y 5/3	5YR 4/4 @ 30"	Very Dense, Cemented
No Refusal					
					Roots to 30"

**Parent Material (geologic):** Glacial Till **Depth of Bedrock:** N/A

**Groundwater Observed:** No If Yes: Depth of Weeping from Pit:

Depth Standing Water in Hole: N/A inches

Estimated Seasonal High Groundwater: 73.4 feet 30"

**Does at least 4-ft of naturally occurring pervious material exist:** NA

Upper Boundary (inches) : NA Lower Boundary (inches): NA

**Certification**

I certify that on NA I have passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise, and experience des

Signature

Date

**DEP APPROVED FORM - 12/07/95**

**Location Address** 11-15 Sunnycrest Ave, Beverly, MA 01915

**On-site Review**

**Deep Hole Number:** 7 **Date:** 11/19/2015 **Time:** 11:30 **Weather:** 40° Cloudy

**Location:** (identify of site plan) **Ground Elevation at Surface of Hole:** 77.0'

**Land Use:** Woodland **Surface Stones:** Boulder Walls, Outcrop

**Vegetation:** Scrub Vegetation **Landform:** Ground Moraine with Bedrock Outcrop

**Slope(%):** 11%

**Distance from:**

Open Water Body NA feet      Drainage Way NA feet  
Possible Wet Area >100 feet      Property Line 68 feet  
Drinking Water Well NA feet      Other \_\_\_\_\_

**DEEP OBSERVATION HOLE LOG**

Depth from Surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Kind & Grade, Consistency, % Gravel, Stones, Boulders .....)
0-8	Ap	FSL	10YR 3/2		Crumble, Friable, Trace Gravel
8-20	Bw	FSL	10YR 4/6		Massive, Friable, Trace Gravel
20-43	C1	SL	10YR 6/6		Massive, Friable, Some Gravel
43-60	C2	SL	2.5Y 6/6	5YR 4/4 @ 43"	Very Dense, Gravelly, Compact
No Refusal					
					Roots to 43"

**Parent Material (geologic):** Glacial Till **Depth of Bedrock:** N/A

**Groundwater Observed:** No      If Yes: Depth of Weeping from Pit: \_\_\_\_\_

Depth Standing Water in Hole: N/A inches

Estimated Seasonal High Groundwater: 73.4' feet      43"

**Does at least 4-ft of naturally occurring pervious material exist:** NA

Upper Boundary (inches) : NA      Lower Boundary (inches): NA

**Certification**

I certify that on NA I have passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise, and experience des

Signature \_\_\_\_\_

Date \_\_\_\_\_

**DEP APPROVED FORM - 12/07/95**

**Location Address** 11-15 Sunnycrest Ave, Beverly, MA 01915

**On-site Review**

**Deep Hole Number:** 8 **Date:** 11/19/2015 **Time:** 12:00 **Weather:** 40° Cloudy

**Location:** (identify of site plan) **Ground Elevation at Surface of Hole:** 69.3'

**Land Use:** Woodland **Surface Stones:** Boulder Walls, Outcrop

**Vegetation:** Scrub Vegetation **Landform:** Ground Moraine with Bedrock Outcrop

**Slope(%):** 10%

**Distance from:**

Open Water Body	<u>NA</u> feet	Drainage Way	<u>NA</u> feet
Possible Wet Area	<u>163</u> feet	Property Line	<u>77</u> feet
Drinking Water Well	<u>NA</u> feet	Other	<u></u>

**DEEP OBSERVATION HOLE LOG**

Depth from Surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Kind & Grade, Consistency, % Gravel, Stones, Boulders .....)
0-8	Ap	FSL	10YR 3/2		Crumble, Friable, Trace Gravel
8-16	Bw	FSL	10YR 4/6		Massive, Friable, Trace Gravel
16-32	C1	SL	10YR 6/6		Massive, Friable, Some Gravel
32-36	C2	SL	2.5Y 6/6	5YR 4/4 @ 32"	Very Dense, Gravelly, Compact
Refusal					
					Roots to 32"

**Parent Material (geologic):** Glacial Till **Depth of Bedrock:** 36"

**Groundwater Observed:** No If Yes: Depth of Weeping from Pit:

Depth Standing Water in Hole: N/A inches

Estimated Seasonal High Groundwater: 66.6 feet 32"

**Does at least 4-ft of naturally occurring pervious material exist:** NA

Upper Boundary (inches) : NA Lower Boundary (inches): NA

**Certification**

I certify that on NA I have passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise, and experience des

Signature

Date

**DEP APPROVED FORM - 12/07/95**



**Location Address** 11-15 Sunnycrest Ave, Beverly, MA 01915

**On-site Review**

**Deep Hole Number:** 9 **Date:** 11/19/2015 **Time:** 12:30 **Weather:** 40° Cloudy

**Location:** (identify of site plan) **Ground Elevation at Surface of Hole:** 71.0'

**Land Use:** Woodland **Surface Stones:** Boulder Walls, Outcrop

**Vegetation:** Scrub Vegetation **Landform:** Ground Moraine with Bedrock Outcrop

**Slope(%):** 12%

**Distance from:**

Open Water Body	<u>NA</u> feet	Drainage Way	<u>NA</u> feet
Possible Wet Area	<u>220</u> feet	Property Line	<u>77</u> feet
Drinking Water Well	<u>NA</u> feet	Other	<u></u>

**DEEP OBSERVATION HOLE LOG**

Depth from Surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Kind & Grade, Consistency, % Gravel, Stones, Boulders .....)
0-8	Ap	FSL	10YR 3/2		Crumble, Friable, Trace Gravel
8-20	Bw	FSL	10YR 4/6		Massive, Friable, Trace Gravel
20-34	C1	SL	10YR 6/6		Massive, Friable, Some Gravel
34-59	C2	SL	2.5Y 6/6	5YR 4/4 @34"	Very Dense, Gravelly, Compact
No Refusal					
					Roots to 34"

**Parent Material (geologic):** Glacial Till **Depth of Bedrock:** N/A

**Groundwater Observed:** No If Yes: Depth of Weeping from Pit:

Depth Standing Water in Hole: N/A inches

Estimated Seasonal High Groundwater: 68.2 feet 34"

**Does at least 4-ft of naturally occurring pervious material exist:** NA

Upper Boundary (inches) : NA Lower Boundary (inches): NA

**Certification**

I certify that on NA I have passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise, and experience des

Signature

Date

**DEP APPROVED FORM - 12/07/95**



**Griffin Engineering Group, LLC**  
495 Cabot Street, 2nd Floor  
Beverly, MA 01915

Phone: 978-927-5111; Fax: 978-927-5103

## **WATER QUALITY VOLUME CALCULATION**

Job Name: Sunnycrest Circle  
Job No: 1514  
Date: 1/7/2016  
Designer: J. Blanchette, PE  
Checked By: R. Griffin, PE

REQUIRED WATER QUALITY VOLUME (WQV) 0.5 inch of runoff

### **TSS REMOVAL CALCULATION**

	Imp. Area (sf)	WQV (cf)	% TSS Removal	Treatment Device
Subcatchment P-1a & c	5,843	243	80%	Drywell - Roof Runoff
Subcatchment P-2a	820	34	80%	Drywell - Roof Runoff
Subcatchment P-3a & b	2,460	103	80%	Drywell - Roof Runoff
Subcatchment P-3c, d & e	23,274	970	85%	Catchbasin, Prop. Separator & Infil. Basin
Subcatchment P-3f	450	19	80%	Veg. Filter Strip & Infil. Basin

#### **Calculations**

$WQV = \text{Imp. Area} \times 0.5\text{-inches} \times 1\text{-foot}/12\text{-inches}$

$\text{Weighted Average \%TSS Removal} = \text{Total Imp. Area} \times \text{TSS} / \text{Total Imp. Area}$

#### **Notes:**

- 1) Refer to attached TSS Removal Calculation Worksheets for %TSS removal for each treatment train.
- 2) Subcatchment P-1b contains existing impervious surfaces (roof and driveway) that are not conveyed to proposed BMPs. Areas are classified as redevelopment.
- 3) Subcatchments P-2b does not contain any impervious surfaces.
- 4) Subcatchment P-3g contains 'de minimus' impervious area (approx. 40 sf ). Size is reduced to the maximum extent practicable.



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## STUCTURAL BMP's SIZING CALCULATIONS

Job Name: Sunnycrest Circle  
Job No: 1514  
Date: 1/7/2016  
Designer: J. Blanchette, PE  
Checked By: R. Griffin, PE

### PROPRIETARY SEPARATOR

Water Quatily Flow (WQF) Calculation  $Q_{0.5} = (qu)(A)(WQV)$

Water Quality Volume = 0.5 cf (First 1/2 inch of Runoff)  
Impervious Area = 23,274 sf  
Area (A) = 0.0008348 sq. miles  
Time of Concentraton = 0.1 hours  
Unit Peak Discharge (qu) = 752 csm/in  
Equivalent WQF (Q0.5) = 0.31 cfs  
TSS Removal Efficiency = 83% (See Attached Graph)

Internal Bypass Configuration. Bypass Flowrate = 0.7 cfs per Manufacturer

### ROOF DRYWELL

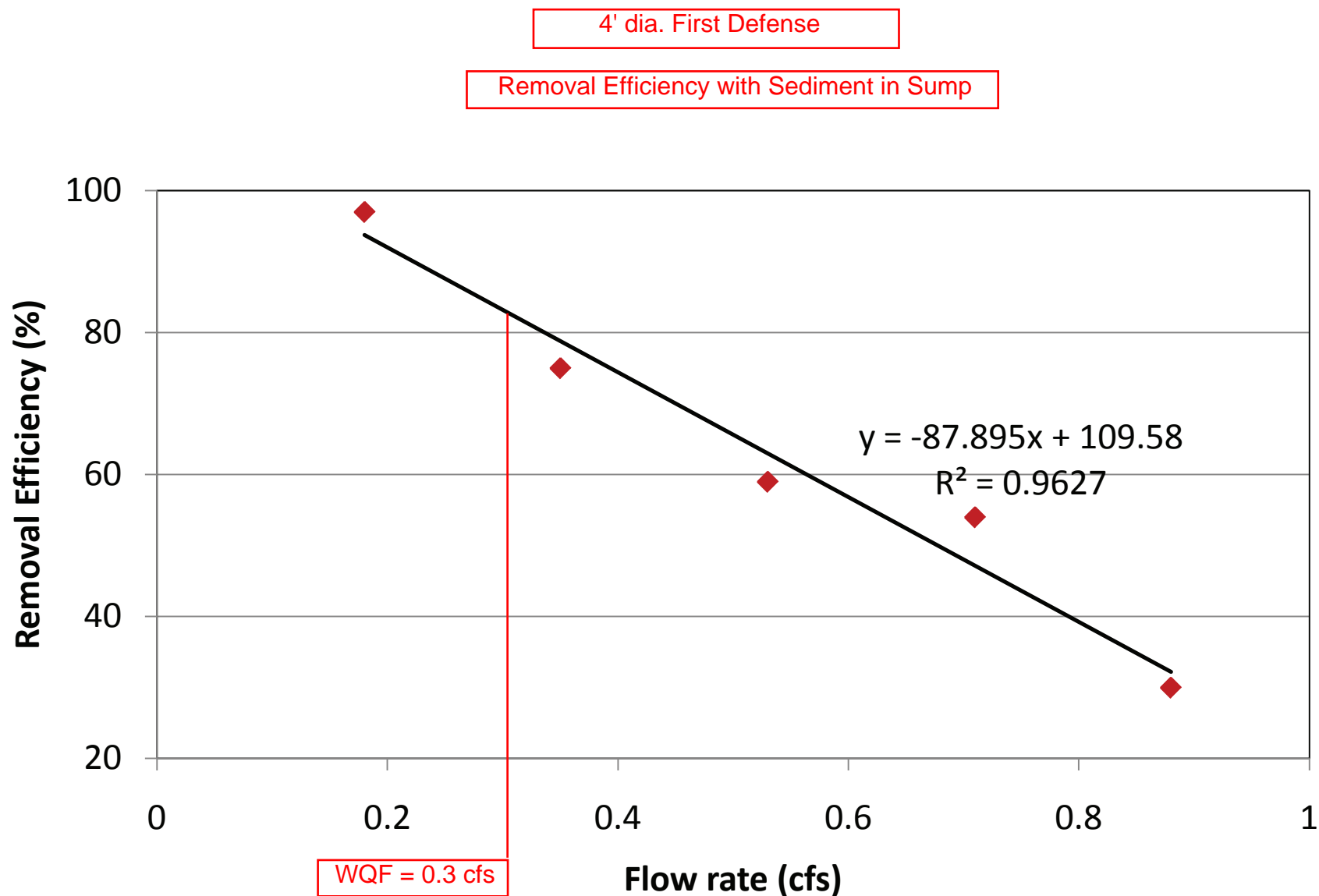
Tributary Imp. Area 820 sf (Rear of Proposed Building)  
Water Quality Volume (WQV) 0.5 inch x impervious area  
Min. Drywell Volume Req'd 34 cf  
Provided Drywell Vol. 134 (Static Vol., Ignoring Stone)

OK

### INFILTRATION BASIN

Tributary Imp. Area 23,724 sf  
Min. Infil. Basin Size 0.5 inch x impervious area  
Min. Req. Infiltration Basin 989 cf  
Provided Basin Volume 1455 cf (below bottom office - see Calc in Recharge Section)

OK



**Figure 7: Removal Efficiency vs. Flow Rate for TSS**

Based on average particle size of 110 micron

## INSTRUCTIONS:

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: To On-Site Wetland

ATTACHMENT B.7

TSS Removal  
Calculation Worksheet

B BMP <sup>1</sup>	C TSS Removal Rate <sup>1</sup>	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Infiltration Basin	0.80	0.75	0.60	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Total TSS Removal =

85%

Separate Form Needs to  
be Completed for Each  
Outlet or BMP Train

Project: Sunnycrest Circle  
Prepared By: J. Blanchette  
Date: 12/22/2015

\*Equals remaining load from previous BMP (E)  
which enters the BMP

## INSTRUCTIONS:

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: To North &amp; West

TSS Removal Calculation Worksheet	B	C	D	E	F
	BMP <sup>1</sup>	TSS Removal Rate <sup>1</sup>	Starting TSS Load*	Amount Removed (C*D)	Remaining Load (D-E)
	Dry Well	0.80	1.00	0.80	0.20
		0.00	0.20	0.00	0.20
		0.00	0.20	0.00	0.20
		0.00	0.20	0.00	0.20
		0.00	0.20	0.00	0.20

Total TSS Removal =

80%

Separate Form Needs to  
be Completed for Each  
Outlet or BMP Train

Project: Sunnycrest Circle

Prepared By: J. Blanchette

Date: 12/22/2015

\*Equals remaining load from previous BMP (E)  
which enters the BMP

Non-automated TSS Calculation Sheet  
must be used if Proprietary BMP Proposed

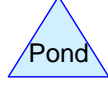
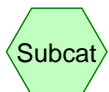
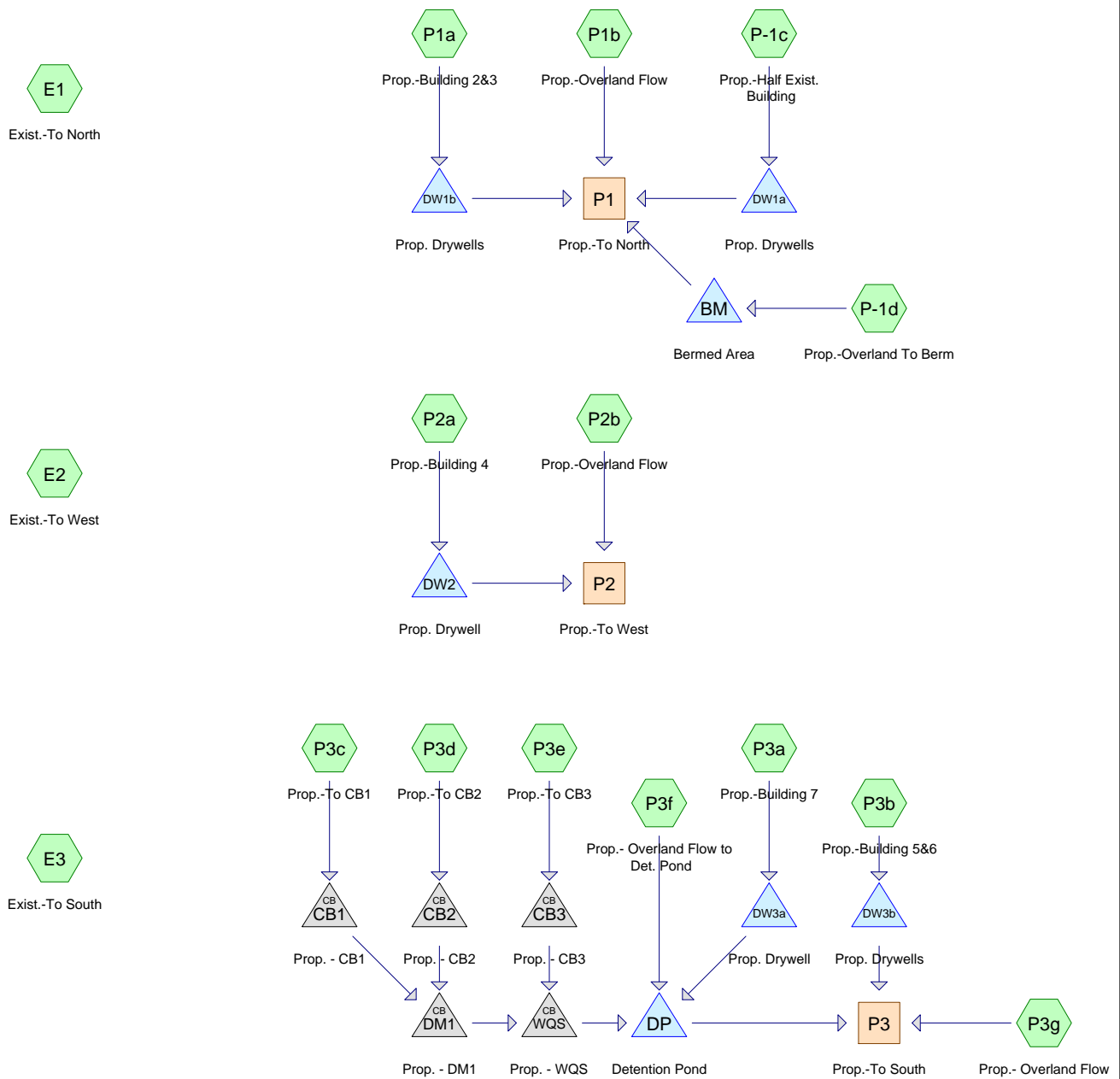
1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

## ATTACHMENT C

### DRAINAGE CALCULATIONS

(2-, 10-, 25-, 100-YEAR  
STORM EVENTS)





**Patch-Sunnycrest**

Type III 24-hr 2-yr Rainfall=3.10"

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**Summary for Subcatchment E1: Exist.-To North**

Runoff = 0.83 cfs @ 12.24 hrs, Volume= 3,776 cf, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	2,844	98	Existing Building & Stairs
*	2,112	98	Existing Driveways & Walkway
	10,098	74	>75% Grass cover, Good, HSG C
	31,544	70	Woods, Good, HSG C
	46,598	74	Weighted Average
	41,642		89.36% Pervious Area
	4,956		10.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	100	0.0500	0.11		<b>Sheet Flow, Woods - Sheet Flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.10"
1.2	124	0.1130	1.68		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b>
					Woodland Kv= 5.0 fps
16.3	224	Total			

**Summary for Subcatchment E2: Exist.-To West**

Runoff = 0.36 cfs @ 12.28 hrs, Volume= 1,766 cf, Depth= 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	650	98	Ledge
	25,235	70	Woods, Good, HSG C
	25,885	71	Weighted Average
	25,235		97.49% Pervious Area
	650		2.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	100	0.0400	0.10		<b>Sheet Flow, Woods - Sheet Flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	136	0.0919	1.52		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b>
					Woodland Kv= 5.0 fps
18.0	236	Total			

**Patch-Sunnycrest**

Type III 24-hr 2-yr Rainfall=3.10"

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**Summary for Subcatchment E3: Exist.-To South**

Runoff = 1.30 cfs @ 12.23 hrs, Volume= 6,011 cf, Depth= 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	1,260	98	Existing Building & Stairs
*	631	98	Existing Driveways & Walkway
	16,604	74	>75% Grass cover, Good, HSG C
	69,619	70	Woods, Good, HSG C
	88,114	71	Weighted Average
	86,223		97.85% Pervious Area
	1,891		2.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	65	0.0385	0.14		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"
5.7	35	0.0714	0.10		<b>Sheet Flow, Woods - Sheet Flow</b> Woods: Light underbrush n= 0.400 P2= 3.10"
1.7	194	0.1399	1.87		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b> Woodland Kv= 5.0 fps
15.3	294	Total			

**Summary for Subcatchment P-1c: Prop.-Half Exist. Building**

Runoff = 0.08 cfs @ 12.08 hrs, Volume= 272 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	1,140	98	Lot 2 - Building Rear Roof
	1,140		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					<b>Direct Entry, Min. 6 Minutes</b>

**Summary for Subcatchment P-1d: Prop.-Overland To Berm**

Runoff = 0.21 cfs @ 12.11 hrs, Volume= 701 cf, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-yr Rainfall=3.10"

**Patch-Sunnycrest**

Type III 24-hr 2-yr Rainfall=3.10"

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Area (sf)	CN	Description
8,647	74	>75% Grass cover, Good, HSG C
8,647		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.1400	0.25		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"

**Summary for Subcatchment P1a: Prop.-Building 2&3**

Runoff = 0.11 cfs @ 12.08 hrs, Volume= 392 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
* 820	98	Lot 2 - Building Rear Roof
* 820	98	Lot 3 - Building Rear Roof
1,640	98	Weighted Average
1,640		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					<b>Direct Entry, Min. 6 Minutes</b>

**Summary for Subcatchment P1b: Prop.-Overland Flow**

Runoff = 0.71 cfs @ 12.11 hrs, Volume= 2,431 cf, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
* 1,601	98	Existing Building Roof
* 1,462	98	Existing Driveways, Walkway, Stairs
14,646	74	>75% Grass cover, Good, HSG C
10,706	70	Woods, Good, HSG C
28,415	75	Weighted Average
25,352		89.22% Pervious Area
3,063		10.78% Impervious Area

**Patch-Sunnycrest**

Type III 24-hr 2-yr Rainfall=3.10"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.1400	0.25		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"
0.2	21	0.0952	2.16		<b>Shallow Concentrated Flow, Grass - Conc. Flow</b> Short Grass Pasture Kv= 7.0 fps
0.5	49	0.0920	1.52		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b> Woodland Kv= 5.0 fps
7.4	170	Total			

**Summary for Subcatchment P2a: Prop.-Building 4**

Runoff = 0.06 cfs @ 12.08 hrs, Volume= 196 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
* 820	98	Lot 4 - Building Rear Roof
820		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					<b>Direct Entry, Min. 6 Minutes</b>

**Summary for Subcatchment P2b: Prop.-Overland Flow**

Runoff = 0.36 cfs @ 12.14 hrs, Volume= 1,368 cf, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
10,095	74	>75% Grass cover, Good, HSG C
8,817	70	Woods, Good, HSG C
18,912	72	Weighted Average
18,912		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	78	0.1666	0.26		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"
3.5	22	0.0909	0.10		<b>Sheet Flow, Woods - Sheet Flow</b> Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	21	0.0714	1.34		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b> Woodland Kv= 5.0 fps
8.9	121	Total			

**Patch-Sunnycrest**

Type III 24-hr 2-yr Rainfall=3.10"

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**Summary for Subcatchment P3a: Prop.-Building 7**

Runoff = 0.06 cfs @ 12.08 hrs, Volume= 196 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
* 820	98	Lot 7 - Building Rear Roof
820		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. 6 Minutes

**Summary for Subcatchment P3b: Prop.-Building 5&6**

Runoff = 0.11 cfs @ 12.08 hrs, Volume= 392 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
* 820	98	Lot 5 - Building Rear Roof
* 820	98	Lot 6 - Building Rear Roof
1,640	98	Weighted Average
1,640		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. 6 Minutes

**Summary for Subcatchment P3c: Prop.-To CB1**

Runoff = 0.31 cfs @ 12.09 hrs, Volume= 975 cf, Depth= 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
* 635	98	Prop. Building & Stairs
* 2,932	98	Prop. Road, Driveway, Sidewalk & Walkway
2,312	74	>75% Grass cover, Good, HSG C
5,879	89	Weighted Average
2,312		39.33% Pervious Area
3,567		60.67% Impervious Area

**Patch-Sunnycrest**

Type III 24-hr 2-yr Rainfall=3.10"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	29	0.0200	0.09		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"
0.5	100	0.0320	3.63		<b>Shallow Concentrated Flow, Gutterline - Conc.Flow</b> Paved Kv= 20.3 fps
0.1					<b>Direct Entry, Min. 6 Minutes</b>
6.0	129	Total			

**Summary for Subcatchment P3d: Prop.-To CB2**

Runoff = 0.17 cfs @ 12.09 hrs, Volume= 530 cf, Depth= 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	2,022	98	Prop. Road, Driveway & Walkway
	1,175	74	>75% Grass cover, Good, HSG C
	3,197	89	Weighted Average
	1,175		36.75% Pervious Area
	2,022		63.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	27	0.0550	0.13		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"
0.4	68	0.0250	3.21		<b>Shallow Concentrated Flow, Gutterline - Conc.Flow</b> Paved Kv= 20.3 fps
2.2					<b>Direct Entry, Min. 6 Minutes</b>
6.0	95	Total			

**Summary for Subcatchment P3e: Prop.-To CB3**

Runoff = 1.47 cfs @ 12.09 hrs, Volume= 4,603 cf, Depth= 2.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	4,388	98	Prop. Building & Stairs
*	13,297	98	Prop. Road, Driveway, Sidewalk & Walkway
	8,922	74	>75% Grass cover, Good, HSG C
	26,607	90	Weighted Average
	8,922		33.53% Pervious Area
	17,685		66.47% Impervious Area

**Patch-Sunnycrest**

Type III 24-hr 2-yr Rainfall=3.10"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					<b>Direct Entry, Min. 6 Minutes</b>

**Summary for Subcatchment P3f: Prop.- Overland Flow to Det. Pond**

Runoff = 0.37 cfs @ 12.12 hrs, Volume= 1,279 cf, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
* 242	98	Building Roof
* 208	98	Prop. Road
14,493	74	>75% Grass cover, Good, HSG C
14,943	75	Weighted Average
14,493		96.99% Pervious Area
450		3.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.1100	0.23		<b>Sheet Flow, Grass - Sheet Flow</b>
					Grass: Dense n= 0.240 P2= 3.10"
0.2	65	0.1690	6.17		<b>Shallow Concentrated Flow, Grass - Concentrated Flow</b>
					Grassed Waterway Kv= 15.0 fps
7.5	165	Total			

**Summary for Subcatchment P3g: Prop.- Overland Flow**

Runoff = 0.85 cfs @ 12.17 hrs, Volume= 3,468 cf, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
* 40	98	Prop. Road
19,652	74	>75% Grass cover, Good, HSG C
28,245	70	Woods, Good, HSG C
47,937	72	Weighted Average
47,897		99.92% Pervious Area
40		0.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	100	0.0650	0.18		<b>Sheet Flow, Grass - Sheet Flow</b>
					Grass: Dense n= 0.240 P2= 3.10"
2.3	214	0.1000	1.58		<b>Shallow Concentrated Flow, Woods - Concentrated Flow</b>
					Woodland Kv= 5.0 fps
11.3	314	Total			

**Patch-Sunnycrest**

Type III 24-hr 2-yr Rainfall=3.10"

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**Summary for Reach P1: Prop.-To North**

Inflow Area = 39,842 sf, 14.67% Impervious, Inflow Depth = 0.73" for 2-yr event  
 Inflow = 0.71 cfs @ 12.11 hrs, Volume= 2,431 cf  
 Outflow = 0.71 cfs @ 12.12 hrs, Volume= 2,431 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Summary for Reach P2: Prop.-To West**

Inflow Area = 19,732 sf, 4.16% Impervious, Inflow Depth = 0.83" for 2-yr event  
 Inflow = 0.36 cfs @ 12.14 hrs, Volume= 1,368 cf  
 Outflow = 0.36 cfs @ 12.15 hrs, Volume= 1,368 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Summary for Reach P3: Prop.-To South**

Inflow Area = 101,023 sf, 25.96% Impervious, Inflow Depth > 0.68" for 2-yr event  
 Inflow = 0.87 cfs @ 12.17 hrs, Volume= 5,692 cf  
 Outflow = 0.87 cfs @ 12.18 hrs, Volume= 5,692 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Summary for Pond BM: Bermed Area**

Inflow Area = 8,647 sf, 0.00% Impervious, Inflow Depth = 0.97" for 2-yr event  
 Inflow = 0.21 cfs @ 12.11 hrs, Volume= 701 cf  
 Outflow = 0.01 cfs @ 15.27 hrs, Volume= 660 cf, Atten= 94%, Lag= 189.7 min  
 Discarded = 0.01 cfs @ 15.27 hrs, Volume= 660 cf  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 67.30' @ 15.27 hrs Surf.Area= 552 sf Storage= 359 cf

Plug-Flow detention time= 349.3 min calculated for 660 cf (94% of inflow)

Center-of-Mass det. time= 319.3 min ( 1,184.1 - 864.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	66.00'	1,390 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
66.00	0	0	0
68.00	848	848	848
68.10	10,000	542	1,390
Device	Routing	Invert	Outlet Devices
#1	Discarded	66.00'	<b>1.020 in/hr Exfiltration over Surface area</b>
#2	Primary	68.00'	<b>91.0' long x 2.0' breadth Broad-Crested Rectangular Weir</b>
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00			



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2.50 3.00 3.50  
 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88  
 2.85 3.07 3.20 3.32

**Discarded OutFlow** Max=0.01 cfs @ 15.27 hrs HW=67.30' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.01 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=66.00' TW=0.00' (Dynamic Tailwater)↑**2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)**Summary for Pond CB1: Prop. - CB1**

Inflow Area = 5,879 sf, 60.67% Impervious, Inflow Depth = 1.99" for 2-yr event  
 Inflow = 0.31 cfs @ 12.09 hrs, Volume= 975 cf  
 Outflow = 0.31 cfs @ 12.10 hrs, Volume= 975 cf, Atten= 0%, Lag= 0.6 min  
 Primary = 0.31 cfs @ 12.10 hrs, Volume= 975 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 75.11' @ 12.11 hrs

Flood Elev= 77.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	74.80'	<b>12.0" Round RCP_Round 12"</b> L= 35.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 74.80' / 74.45' S= 0.0100 '/ Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.30 cfs @ 12.10 hrs HW=75.11' TW=74.87' (Dynamic Tailwater)↑**1=RCP\_Round 12"** (Outlet Controls 0.30 cfs @ 2.19 fps)**Summary for Pond CB2: Prop. - CB2**

Inflow Area = 3,197 sf, 63.25% Impervious, Inflow Depth = 1.99" for 2-yr event  
 Inflow = 0.17 cfs @ 12.09 hrs, Volume= 530 cf  
 Outflow = 0.17 cfs @ 12.10 hrs, Volume= 530 cf, Atten= 0%, Lag= 0.6 min  
 Primary = 0.17 cfs @ 12.10 hrs, Volume= 530 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 76.50' @ 12.10 hrs

Flood Elev= 79.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	76.30'	<b>12.0" Round RCP_Round 12"</b> L= 12.2' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 76.30' / 76.15' S= 0.0123 '/ Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.17 cfs @ 12.10 hrs HW=76.50' TW=74.87' (Dynamic Tailwater)↑**1=RCP\_Round 12"** (Barrel Controls 0.17 cfs @ 2.27 fps)

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**Summary for Pond CB3: Prop. - CB3**

Inflow Area = 26,607 sf, 66.47% Impervious, Inflow Depth = 2.08" for 2-yr event  
 Inflow = 1.47 cfs @ 12.09 hrs, Volume= 4,603 cf  
 Outflow = 1.47 cfs @ 12.10 hrs, Volume= 4,603 cf, Atten= 0%, Lag= 0.6 min  
 Primary = 1.47 cfs @ 12.10 hrs, Volume= 4,603 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 76.05' @ 12.10 hrs

Flood Elev= 78.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	75.40'	<b>12.0" Round RCP_Round 12"</b> L= 140.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 75.40' / 74.00' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.47 cfs @ 12.10 hrs HW=76.05' TW=74.77' (Dynamic Tailwater)

↑1=RCP\_Round 12" (Inlet Controls 1.47 cfs @ 2.74 fps)

**Summary for Pond DM1: Prop. - DM1**

Inflow Area = 9,076 sf, 61.58% Impervious, Inflow Depth = 1.99" for 2-yr event  
 Inflow = 0.48 cfs @ 12.10 hrs, Volume= 1,505 cf  
 Outflow = 0.48 cfs @ 12.11 hrs, Volume= 1,505 cf, Atten= 0%, Lag= 0.6 min  
 Primary = 0.48 cfs @ 12.11 hrs, Volume= 1,505 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 74.88' @ 12.12 hrs

Flood Elev= 79.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	74.35'	<b>12.0" Round RCP_Round 12"</b> L= 37.2' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 74.35' / 74.00' S= 0.0094 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.47 cfs @ 12.11 hrs HW=74.88' TW=74.77' (Dynamic Tailwater)

↑1=RCP\_Round 12" (Outlet Controls 0.47 cfs @ 1.63 fps)

**Summary for Pond DP: Detention Pond**

Inflow Area = 51,446 sf, 47.71% Impervious, Inflow Depth = 1.72" for 2-yr event  
 Inflow = 2.33 cfs @ 12.11 hrs, Volume= 7,387 cf  
 Outflow = 0.11 cfs @ 15.28 hrs, Volume= 5,613 cf, Atten= 95%, Lag= 190.3 min  
 Discarded = 0.05 cfs @ 15.28 hrs, Volume= 3,390 cf  
 Primary = 0.05 cfs @ 15.28 hrs, Volume= 2,224 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

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Peak Elev= 60.83' @ 15.28 hrs Surf.Area= 2,257 sf Storage= 4,400 cf

Flood Elev= 64.00' Surf.Area= 4,173 sf Storage= 14,463 cf

Plug-Flow detention time= 427.8 min calculated for 5,612 cf (76% of inflow)

Center-of-Mass det. time= 341.7 min ( 1,161.2 - 819.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	14,463 cf	<b>Custom Stage Data (Conic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
58.00	914	0	0	914
60.00	1,834	2,695	2,695	1,870
62.00	2,920	4,712	7,407	3,009
64.00	4,173	7,056	14,463	4,330

Device	Routing	Invert	Outlet Devices
#1	Primary	56.50'	<b>12.0" Round Culvert</b> L= 43.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 56.50' / 54.00' S= 0.0575 ' / Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	59.25'	<b>1.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	60.25'	<b>1.0" Vert. Orifice/Grate</b> C= 0.600
#4	Device 1	61.25'	<b>1.2" Vert. Orifice/Grate</b> C= 0.600
#5	Device 1	62.25'	<b>1.5" Vert. Orifice/Grate</b> C= 0.600
#6	Device 1	63.25'	<b>30.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#7	Primary	63.50'	<b>8.0' long x 6.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#8	Discarded	58.00'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.05 cfs @ 15.28 hrs HW=60.83' (Free Discharge)↑ **8=Exfiltration** (Exfiltration Controls 0.05 cfs)**Primary OutFlow** Max=0.05 cfs @ 15.28 hrs HW=60.83' TW=0.00' (Dynamic Tailwater)

↑ **1=Culvert** (Passes 0.05 cfs of 7.41 cfs potential flow)

↑ **2=Orifice/Grate** (Orifice Controls 0.03 cfs @ 5.98 fps)

↑ **3=Orifice/Grate** (Orifice Controls 0.02 cfs @ 3.55 fps)

↑ **4=Orifice/Grate** ( Controls 0.00 cfs)

↑ **5=Orifice/Grate** ( Controls 0.00 cfs)

↑ **6=Orifice/Grate** ( Controls 0.00 cfs)

↑ **7=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

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**Summary for Pond DW1a: Prop. Drywells**

Inflow Area = 1,140 sf, 100.00% Impervious, Inflow Depth = 2.87" for 2-yr event  
 Inflow = 0.08 cfs @ 12.08 hrs, Volume= 272 cf  
 Outflow = 0.00 cfs @ 8.65 hrs, Volume= 196 cf, Atten= 97%, Lag= 0.0 min  
 Discarded = 0.00 cfs @ 8.65 hrs, Volume= 196 cf  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 78.94' @ 15.94 hrs Surf.Area= 96 sf Storage= 157 cf

Plug-Flow detention time= 407.8 min calculated for 196 cf (72% of inflow)  
 Center-of-Mass det. time= 316.8 min ( 1,073.9 - 757.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	76.50'	66 cf	<b>7.67'W x 12.50'L x 3.50'H Prismatic</b> 336 cf Overall - 170 cf Embedded = 166 cf x 40.0% Voids
#2	77.00'	149 cf	<b>5.67'W x 10.50'L x 2.50'H Prismatic</b> Inside #1 170 cf Overall - 3.0" Wall Thickness = 149 cf
#3	79.50'	5 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> -Impervious
#4	81.00'	1,250 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) -Impervious
		1,470 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
81.00	2	0	0
81.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	76.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	81.00'	<b>20.0" Horiz. Orifice/Grate</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 8.65 hrs HW=76.51' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.00 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=76.50' TW=0.00' (Dynamic Tailwater)  
 ↑2=Orifice/Grate ( Controls 0.00 cfs)

**Summary for Pond DW1b: Prop. Drywells**

Inflow Area = 1,640 sf, 100.00% Impervious, Inflow Depth = 2.87" for 2-yr event  
 Inflow = 0.11 cfs @ 12.08 hrs, Volume= 392 cf  
 Outflow = 0.00 cfs @ 9.57 hrs, Volume= 377 cf, Atten= 96%, Lag= 0.0 min  
 Discarded = 0.00 cfs @ 9.57 hrs, Volume= 377 cf  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 75.12' @ 15.00 hrs Surf.Area= 192 sf Storage= 196 cf

Plug-Flow detention time= 364.8 min calculated for 377 cf (96% of inflow)

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Center-of-Mass det. time= 342.0 min ( 1,099.1 - 757.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	73.50'	133 cf	<b>7.67'W x 12.50'L x 3.50'H Prismaoid</b> x 2 671 cf Overall - 339 cf Embedded = 332 cf x 40.0% Voids
#2	74.00'	298 cf	<b>5.67'W x 10.50'L x 2.50'H Prismaoid</b> x 2 Inside #1 339 cf Overall - 3.0" Wall Thickness = 298 cf
#3	76.50'	9 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> x 2 -Impervious
#4	78.00'	2,501 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) x 2 -Impervious
		2,940 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
78.00	2	0	0
78.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	73.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	78.00'	<b>20.0" Horiz. Orifice/Grate X 2.00</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 9.57 hrs HW=73.51' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=73.50' TW=0.00' (Dynamic Tailwater)↑**2=Orifice/Grate** ( Controls 0.00 cfs)**Summary for Pond DW2: Prop. Drywell**

Inflow Area = 820 sf, 100.00% Impervious, Inflow Depth = 2.87" for 2-yr event  
 Inflow = 0.06 cfs @ 12.08 hrs, Volume= 196 cf  
 Outflow = 0.00 cfs @ 9.57 hrs, Volume= 189 cf, Atten= 96%, Lag= 0.0 min  
 Discarded = 0.00 cfs @ 9.57 hrs, Volume= 189 cf  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 70.12' @ 15.00 hrs Surf.Area= 96 sf Storage= 98 cf

Plug-Flow detention time= 364.8 min calculated for 189 cf (96% of inflow)

Center-of-Mass det. time= 342.0 min ( 1,099.1 - 757.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	66 cf	<b>7.67'W x 12.50'L x 3.50'H Prismaoid</b> 336 cf Overall - 170 cf Embedded = 166 cf x 40.0% Voids
#2	69.00'	149 cf	<b>5.67'W x 10.50'L x 2.50'H Prismaoid</b> Inside #1 170 cf Overall - 3.0" Wall Thickness = 149 cf
#3	71.50'	5 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> -Impervious
#4	73.00'	1,250 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) -Impervious
		1,470 cf	Total Available Storage

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
73.00	2	0	0
73.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	68.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	73.00'	<b>20.0" Horiz. Orifice/Grate</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 9.57 hrs HW=68.51' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=68.50' TW=0.00' (Dynamic Tailwater)↑**2=Orifice/Grate** ( Controls 0.00 cfs)**Summary for Pond DW3a: Prop. Drywell**

Inflow Area = 820 sf, 100.00% Impervious, Inflow Depth = 2.87" for 2-yr event  
 Inflow = 0.06 cfs @ 12.08 hrs, Volume= 196 cf  
 Outflow = 0.00 cfs @ 9.57 hrs, Volume= 189 cf, Atten= 96%, Lag= 0.0 min  
 Discarded = 0.00 cfs @ 9.57 hrs, Volume= 189 cf  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 70.12' @ 15.00 hrs Surf.Area= 96 sf Storage= 98 cf

Plug-Flow detention time= 364.8 min calculated for 189 cf (96% of inflow)

Center-of-Mass det. time= 342.0 min ( 1,099.1 - 757.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	66 cf	<b>7.67'W x 12.50'L x 3.50'H Prismatic</b> 336 cf Overall - 170 cf Embedded = 166 cf x 40.0% Voids
#2	69.00'	149 cf	<b>5.67'W x 10.50'L x 2.50'H Prismatic</b> Inside #1 170 cf Overall - 3.0" Wall Thickness = 149 cf
#3	71.50'	5 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> -Impervious
#4	73.00'	1,250 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) -Impervious
		1,470 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
73.00	2	0	0
73.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	68.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	73.00'	<b>20.0" Horiz. Orifice/Grate</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

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**Discarded OutFlow** Max=0.00 cfs @ 9.57 hrs HW=68.51' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=68.50' TW=58.00' (Dynamic Tailwater)↑**2=Orifice/Grate** ( Controls 0.00 cfs)**Summary for Pond DW3b: Prop. Drywells**

Inflow Area = 1,640 sf, 100.00% Impervious, Inflow Depth = 2.87" for 2-yr event  
 Inflow = 0.11 cfs @ 12.08 hrs, Volume= 392 cf  
 Outflow = 0.00 cfs @ 9.57 hrs, Volume= 377 cf, Atten= 96%, Lag= 0.0 min  
 Discarded = 0.00 cfs @ 9.57 hrs, Volume= 377 cf  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 69.12' @ 15.00 hrs Surf.Area= 192 sf Storage= 196 cf

Plug-Flow detention time= 364.8 min calculated for 377 cf (96% of inflow)

Center-of-Mass det. time= 342.0 min ( 1,099.1 - 757.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	67.50'	133 cf	<b>7.67'W x 12.50'L x 3.50'H Prismatic</b> x 2 671 cf Overall - 339 cf Embedded = 332 cf x 40.0% Voids
#2	68.00'	298 cf	<b>5.67'W x 10.50'L x 2.50'H Prismatic</b> x 2 Inside #1 339 cf Overall - 3.0" Wall Thickness = 298 cf
#3	70.50'	9 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> x 2 -Impervious
#4	72.00'	2,501 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) x 2 -Impervious
		2,940 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
72.00	2	0	0
72.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	67.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	72.00'	<b>20.0" Horiz. Orifice/Grate X 2.00</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 9.57 hrs HW=67.51' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=67.50' TW=0.00' (Dynamic Tailwater)↑**2=Orifice/Grate** ( Controls 0.00 cfs)

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**Summary for Pond WQS: Prop. - WQS**

Inflow Area = 35,683 sf, 65.22% Impervious, Inflow Depth = 2.05" for 2-yr event  
Inflow = 1.95 cfs @ 12.10 hrs, Volume= 6,109 cf  
Outflow = 1.95 cfs @ 12.11 hrs, Volume= 6,109 cf, Atten= 0%, Lag= 0.6 min  
Primary = 1.95 cfs @ 12.11 hrs, Volume= 6,109 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 74.77' @ 12.11 hrs

Flood Elev= 80.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	74.00'	<b>12.0" Round OUTFALL</b> L= 167.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 74.00' / 58.00' S= 0.0958 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.95 cfs @ 12.11 hrs HW=74.77' TW=59.55' (Dynamic Tailwater)↑**1=OUTFALL** (Inlet Controls 1.95 cfs @ 2.99 fps)



**Patch-Sunnycrest**

Type III 24-hr 10-yr Rainfall=4.50"

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**Summary for Subcatchment E1: Exist.-To North**

Runoff = 1.79 cfs @ 12.23 hrs, Volume= 7,659 cf, Depth= 1.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	2,844	98	Existing Building & Stairs
*	2,112	98	Existing Driveways & Walkway
	10,098	74	>75% Grass cover, Good, HSG C
	31,544	70	Woods, Good, HSG C
	46,598	74	Weighted Average
	41,642		89.36% Pervious Area
	4,956		10.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	100	0.0500	0.11		<b>Sheet Flow, Woods - Sheet Flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.10"
1.2	124	0.1130	1.68		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b>
					Woodland Kv= 5.0 fps
16.3	224	Total			

**Summary for Subcatchment E2: Exist.-To West**

Runoff = 0.83 cfs @ 12.26 hrs, Volume= 3,767 cf, Depth= 1.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	650	98	Ledge
	25,235	70	Woods, Good, HSG C
	25,885	71	Weighted Average
	25,235		97.49% Pervious Area
	650		2.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	100	0.0400	0.10		<b>Sheet Flow, Woods - Sheet Flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	136	0.0919	1.52		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b>
					Woodland Kv= 5.0 fps
18.0	236	Total			

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Type III 24-hr 10-yr Rainfall=4.50"

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**Summary for Subcatchment E3: Exist.-To South**

Runoff = 3.02 cfs @ 12.22 hrs, Volume= 12,823 cf, Depth= 1.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	1,260	98	Existing Building & Stairs
*	631	98	Existing Driveways & Walkway
	16,604	74	>75% Grass cover, Good, HSG C
	69,619	70	Woods, Good, HSG C
	88,114	71	Weighted Average
	86,223		97.85% Pervious Area
	1,891		2.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	65	0.0385	0.14		<b>Sheet Flow, Grass - Sheet Flow</b>
					Grass: Dense n= 0.240 P2= 3.10"
5.7	35	0.0714	0.10		<b>Sheet Flow, Woods - Sheet Flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.10"
1.7	194	0.1399	1.87		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b>
					Woodland Kv= 5.0 fps
15.3	294	Total			

**Summary for Subcatchment P-1c: Prop.-Half Exist. Building**

Runoff = 0.12 cfs @ 12.08 hrs, Volume= 405 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	1,140	98	Lot 2 - Building Rear Roof
	1,140		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					<b>Direct Entry, Min. 6 Minutes</b>

**Summary for Subcatchment P-1d: Prop.-Overland To Berm**

Runoff = 0.44 cfs @ 12.10 hrs, Volume= 1,421 cf, Depth= 1.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-yr Rainfall=4.50"

**Patch-Sunnycrest**

Type III 24-hr 10-yr Rainfall=4.50"

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Area (sf)	CN	Description
8,647	74	>75% Grass cover, Good, HSG C
8,647		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.1400	0.25		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"

**Summary for Subcatchment P1a: Prop.-Building 2&3**

Runoff = 0.17 cfs @ 12.08 hrs, Volume= 583 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
* 820	98	Lot 2 - Building Rear Roof
* 820	98	Lot 3 - Building Rear Roof
1,640	98	Weighted Average
1,640		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					<b>Direct Entry, Min. 6 Minutes</b>

**Summary for Subcatchment P1b: Prop.-Overland Flow**

Runoff = 1.48 cfs @ 12.11 hrs, Volume= 4,855 cf, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
* 1,601	98	Existing Building Roof
* 1,462	98	Existing Driveways, Walkway, Stairs
14,646	74	>75% Grass cover, Good, HSG C
10,706	70	Woods, Good, HSG C
28,415	75	Weighted Average
25,352		89.22% Pervious Area
3,063		10.78% Impervious Area

**Patch-Sunnycrest**

Type III 24-hr 10-yr Rainfall=4.50"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.1400	0.25		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"
0.2	21	0.0952	2.16		<b>Shallow Concentrated Flow, Grass - Conc. Flow</b> Short Grass Pasture Kv= 7.0 fps
0.5	49	0.0920	1.52		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b> Woodland Kv= 5.0 fps
7.4	170	Total			

**Summary for Subcatchment P2a: Prop.-Building 4**

Runoff = 0.08 cfs @ 12.08 hrs, Volume= 291 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
* 820	98	Lot 4 - Building Rear Roof
820		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					<b>Direct Entry, Min. 6 Minutes</b>

**Summary for Subcatchment P2b: Prop.-Overland Flow**

Runoff = 0.82 cfs @ 12.13 hrs, Volume= 2,869 cf, Depth= 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
10,095	74	>75% Grass cover, Good, HSG C
8,817	70	Woods, Good, HSG C
18,912	72	Weighted Average
18,912		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	78	0.1666	0.26		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"
3.5	22	0.0909	0.10		<b>Sheet Flow, Woods - Sheet Flow</b> Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	21	0.0714	1.34		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b> Woodland Kv= 5.0 fps
8.9	121	Total			

**Patch-Sunnycrest**

Type III 24-hr 10-yr Rainfall=4.50"

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**Summary for Subcatchment P3a: Prop.-Building 7**

Runoff = 0.08 cfs @ 12.08 hrs, Volume= 291 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
* 820	98	Lot 7 - Building Rear Roof
820		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. 6 Minutes

**Summary for Subcatchment P3b: Prop.-Building 5&6**

Runoff = 0.17 cfs @ 12.08 hrs, Volume= 583 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
* 820	98	Lot 5 - Building Rear Roof
* 820	98	Lot 6 - Building Rear Roof
1,640	98	Weighted Average
1,640		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. 6 Minutes

**Summary for Subcatchment P3c: Prop.-To CB1**

Runoff = 0.51 cfs @ 12.09 hrs, Volume= 1,614 cf, Depth= 3.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
* 635	98	Prop. Building & Stairs
* 2,932	98	Prop. Road, Driveway, Sidewalk & Walkway
2,312	74	>75% Grass cover, Good, HSG C
5,879	89	Weighted Average
2,312		39.33% Pervious Area
3,567		60.67% Impervious Area

**Patch-Sunnycrest**

Type III 24-hr 10-yr Rainfall=4.50"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	29	0.0200	0.09		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"
0.5	100	0.0320	3.63		<b>Shallow Concentrated Flow, Gutterline - Conc.Flow</b> Paved Kv= 20.3 fps
0.1					<b>Direct Entry, Min. 6 Minutes</b>
6.0	129	Total			

**Summary for Subcatchment P3d: Prop.-To CB2**

Runoff = 0.28 cfs @ 12.09 hrs, Volume= 878 cf, Depth= 3.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	2,022	98	Prop. Road, Driveway & Walkway
	1,175	74	>75% Grass cover, Good, HSG C
	3,197	89	Weighted Average
	1,175		36.75% Pervious Area
	2,022		63.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	27	0.0550	0.13		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"
0.4	68	0.0250	3.21		<b>Shallow Concentrated Flow, Gutterline - Conc.Flow</b> Paved Kv= 20.3 fps
2.2					<b>Direct Entry, Min. 6 Minutes</b>
6.0	95	Total			

**Summary for Subcatchment P3e: Prop.-To CB3**

Runoff = 2.36 cfs @ 12.09 hrs, Volume= 7,529 cf, Depth= 3.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	4,388	98	Prop. Building & Stairs
*	13,297	98	Prop. Road, Driveway, Sidewalk & Walkway
	8,922	74	>75% Grass cover, Good, HSG C
	26,607	90	Weighted Average
	8,922		33.53% Pervious Area
	17,685		66.47% Impervious Area

**Patch-Sunnycrest**

Type III 24-hr 10-yr Rainfall=4.50"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					<b>Direct Entry, Min. 6 Minutes</b>

**Summary for Subcatchment P3f: Prop.- Overland Flow to Det. Pond**

Runoff = 0.78 cfs @ 12.11 hrs, Volume= 2,553 cf, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
* 242	98	Building Roof
* 208	98	Prop. Road
14,493	74	>75% Grass cover, Good, HSG C
14,943	75	Weighted Average
14,493		96.99% Pervious Area
450		3.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.1100	0.23		<b>Sheet Flow, Grass - Sheet Flow</b>
					Grass: Dense n= 0.240 P2= 3.10"
0.2	65	0.1690	6.17		<b>Shallow Concentrated Flow, Grass - Concentrated Flow</b>
					Grassed Waterway Kv= 15.0 fps
7.5	165	Total			

**Summary for Subcatchment P3g: Prop.- Overland Flow**

Runoff = 1.93 cfs @ 12.16 hrs, Volume= 7,272 cf, Depth= 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
* 40	98	Prop. Road
19,652	74	>75% Grass cover, Good, HSG C
28,245	70	Woods, Good, HSG C
47,937	72	Weighted Average
47,897		99.92% Pervious Area
40		0.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	100	0.0650	0.18		<b>Sheet Flow, Grass - Sheet Flow</b>
					Grass: Dense n= 0.240 P2= 3.10"
2.3	214	0.1000	1.58		<b>Shallow Concentrated Flow, Woods - Concentrated Flow</b>
					Woodland Kv= 5.0 fps
11.3	314	Total			

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Type III 24-hr 10-yr Rainfall=4.50"

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**Summary for Reach P1: Prop.-To North**

Inflow Area = 39,842 sf, 14.67% Impervious, Inflow Depth = 1.48" for 10-yr event  
 Inflow = 1.48 cfs @ 12.11 hrs, Volume= 4,898 cf  
 Outflow = 1.48 cfs @ 12.12 hrs, Volume= 4,898 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Summary for Reach P2: Prop.-To West**

Inflow Area = 19,732 sf, 4.16% Impervious, Inflow Depth = 1.74" for 10-yr event  
 Inflow = 0.82 cfs @ 12.13 hrs, Volume= 2,869 cf  
 Outflow = 0.82 cfs @ 12.14 hrs, Volume= 2,869 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Summary for Reach P3: Prop.-To South**

Inflow Area = 101,023 sf, 25.96% Impervious, Inflow Depth > 1.46" for 10-yr event  
 Inflow = 1.98 cfs @ 12.16 hrs, Volume= 12,328 cf  
 Outflow = 1.98 cfs @ 12.17 hrs, Volume= 12,328 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Summary for Pond BM: Bermed Area**

Inflow Area = 8,647 sf, 0.00% Impervious, Inflow Depth = 1.97" for 10-yr event  
 Inflow = 0.44 cfs @ 12.10 hrs, Volume= 1,421 cf  
 Outflow = 0.02 cfs @ 15.73 hrs, Volume= 1,137 cf, Atten= 96%, Lag= 217.6 min  
 Discarded = 0.02 cfs @ 15.73 hrs, Volume= 1,137 cf  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 67.99' @ 15.73 hrs Surf.Area= 845 sf Storage= 842 cf

Plug-Flow detention time= 446.7 min calculated for 1,137 cf (80% of inflow)

Center-of-Mass det. time= 367.0 min ( 1,210.4 - 843.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	66.00'	1,390 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
66.00	0	0	0
68.00	848	848	848
68.10	10,000	542	1,390
Device	Routing	Invert	Outlet Devices
#1	Discarded	66.00'	<b>1.020 in/hr Exfiltration over Surface area</b>
#2	Primary	68.00'	<b>91.0' long x 2.0' breadth Broad-Crested Rectangular Weir</b>
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00			



**Patch-Sunnycrest**

Type III 24-hr 10-yr Rainfall=4.50"

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2.50 3.00 3.50

Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88

2.85 3.07 3.20 3.32

**Discarded OutFlow** Max=0.02 cfs @ 15.73 hrs HW=67.99' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=66.00' TW=0.00' (Dynamic Tailwater)↑**2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)**Summary for Pond CB1: Prop. - CB1**

Inflow Area = 5,879 sf, 60.67% Impervious, Inflow Depth = 3.30" for 10-yr event  
 Inflow = 0.51 cfs @ 12.09 hrs, Volume= 1,614 cf  
 Outflow = 0.51 cfs @ 12.10 hrs, Volume= 1,614 cf, Atten= 0%, Lag= 0.6 min  
 Primary = 0.51 cfs @ 12.10 hrs, Volume= 1,614 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 75.35' @ 12.12 hrs

Flood Elev= 77.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	74.80'	<b>12.0" Round RCP_Round 12"</b> L= 35.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 74.80' / 74.45' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.42 cfs @ 12.10 hrs HW=75.30' TW=75.21' (Dynamic Tailwater)↑**1=RCP\_Round 12"** (Outlet Controls 0.42 cfs @ 1.54 fps)**Summary for Pond CB2: Prop. - CB2**

Inflow Area = 3,197 sf, 63.25% Impervious, Inflow Depth = 3.30" for 10-yr event  
 Inflow = 0.28 cfs @ 12.09 hrs, Volume= 878 cf  
 Outflow = 0.28 cfs @ 12.10 hrs, Volume= 878 cf, Atten= 0%, Lag= 0.6 min  
 Primary = 0.28 cfs @ 12.10 hrs, Volume= 878 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 76.57' @ 12.10 hrs

Flood Elev= 79.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	76.30'	<b>12.0" Round RCP_Round 12"</b> L= 12.2' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 76.30' / 76.15' S= 0.0123 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.28 cfs @ 12.10 hrs HW=76.56' TW=75.21' (Dynamic Tailwater)↑**1=RCP\_Round 12"** (Barrel Controls 0.28 cfs @ 2.50 fps)

**Patch-Sunnycrest**

Type III 24-hr 10-yr Rainfall=4.50"

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**Summary for Pond CB3: Prop. - CB3**

Inflow Area = 26,607 sf, 66.47% Impervious, Inflow Depth = 3.40" for 10-yr event  
 Inflow = 2.36 cfs @ 12.09 hrs, Volume= 7,529 cf  
 Outflow = 2.36 cfs @ 12.10 hrs, Volume= 7,529 cf, Atten= 0%, Lag= 0.6 min  
 Primary = 2.36 cfs @ 12.10 hrs, Volume= 7,529 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 76.29' @ 12.10 hrs  
 Flood Elev= 78.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	75.40'	<b>12.0" Round RCP_Round 12"</b> L= 140.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 75.40' / 74.00' S= 0.0100 '/ Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

**Primary OutFlow** Max=2.33 cfs @ 12.10 hrs HW=76.29' TW=75.17' (Dynamic Tailwater)  
 ↑1=RCP\_Round 12" (Outlet Controls 2.33 cfs @ 4.20 fps)

**Summary for Pond DM1: Prop. - DM1**

Inflow Area = 9,076 sf, 61.58% Impervious, Inflow Depth = 3.30" for 10-yr event  
 Inflow = 0.79 cfs @ 12.10 hrs, Volume= 2,492 cf  
 Outflow = 0.79 cfs @ 12.11 hrs, Volume= 2,492 cf, Atten= 0%, Lag= 0.6 min  
 Primary = 0.79 cfs @ 12.11 hrs, Volume= 2,492 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 75.25' @ 12.12 hrs  
 Flood Elev= 79.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	74.35'	<b>12.0" Round RCP_Round 12"</b> L= 37.2' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 74.35' / 74.00' S= 0.0094 '/ Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.69 cfs @ 12.11 hrs HW=75.24' TW=75.19' (Dynamic Tailwater)  
 ↑1=RCP\_Round 12" (Outlet Controls 0.69 cfs @ 1.24 fps)

**Summary for Pond DP: Detention Pond**

Inflow Area = 51,446 sf, 47.71% Impervious, Inflow Depth = 2.93" for 10-yr event  
 Inflow = 3.92 cfs @ 12.11 hrs, Volume= 12,575 cf  
 Outflow = 0.18 cfs @ 14.95 hrs, Volume= 9,485 cf, Atten= 95%, Lag= 170.6 min  
 Discarded = 0.07 cfs @ 14.95 hrs, Volume= 4,428 cf  
 Primary = 0.11 cfs @ 14.95 hrs, Volume= 5,057 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Patch-Sunnycrest**

Type III 24-hr 10-yr Rainfall=4.50"

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Peak Elev= 62.09' @ 14.95 hrs Surf.Area= 2,974 sf Storage= 7,686 cf

Flood Elev= 64.00' Surf.Area= 4,173 sf Storage= 14,463 cf

Plug-Flow detention time= 433.0 min calculated for 9,482 cf (75% of inflow)

Center-of-Mass det. time= 347.4 min ( 1,153.1 - 805.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	14,463 cf	<b>Custom Stage Data (Conic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
58.00	914	0	0	914
60.00	1,834	2,695	2,695	1,870
62.00	2,920	4,712	7,407	3,009
64.00	4,173	7,056	14,463	4,330

Device	Routing	Invert	Outlet Devices
#1	Primary	56.50'	<b>12.0" Round Culvert</b> L= 43.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 56.50' / 54.00' S= 0.0575 ' S= 0.0575 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	59.25'	<b>1.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	60.25'	<b>1.0" Vert. Orifice/Grate</b> C= 0.600
#4	Device 1	61.25'	<b>1.2" Vert. Orifice/Grate</b> C= 0.600
#5	Device 1	62.25'	<b>1.5" Vert. Orifice/Grate</b> C= 0.600
#6	Device 1	63.25'	<b>30.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#7	Primary	63.50'	<b>8.0' long x 6.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#8	Discarded	58.00'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.07 cfs @ 14.95 hrs HW=62.09' (Free Discharge)↑ **8=Exfiltration** (Exfiltration Controls 0.07 cfs)**Primary OutFlow** Max=0.11 cfs @ 14.95 hrs HW=62.09' TW=0.00' (Dynamic Tailwater)

- ↑ **1=Culvert** (Passes 0.11 cfs of 8.54 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 0.04 cfs @ 8.06 fps)
- ↑ **3=Orifice/Grate** (Orifice Controls 0.04 cfs @ 6.47 fps)
- ↑ **4=Orifice/Grate** (Orifice Controls 0.03 cfs @ 4.29 fps)
- ↑ **5=Orifice/Grate** ( Controls 0.00 cfs)
- ↑ **6=Orifice/Grate** ( Controls 0.00 cfs)
- ↑ **7=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

**Patch-Sunnycrest**

Type III 24-hr 10-yr Rainfall=4.50"

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**Summary for Pond DW1a: Prop. Drywells**

Inflow Area = 1,140 sf, 100.00% Impervious, Inflow Depth = 4.26" for 10-yr event  
 Inflow = 0.12 cfs @ 12.08 hrs, Volume= 405 cf  
 Outflow = 0.01 cfs @ 12.95 hrs, Volume= 252 cf, Atten= 91%, Lag= 51.9 min  
 Discarded = 0.00 cfs @ 7.29 hrs, Volume= 209 cf  
 Primary = 0.01 cfs @ 12.95 hrs, Volume= 43 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 81.01' @ 12.95 hrs Surf.Area= 96 sf Storage= 221 cf

Plug-Flow detention time= 353.4 min calculated for 252 cf (62% of inflow)  
 Center-of-Mass det. time= 246.8 min ( 996.7 - 749.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	76.50'	66 cf	<b>7.67'W x 12.50'L x 3.50'H Prismatic</b> 336 cf Overall - 170 cf Embedded = 166 cf x 40.0% Voids
#2	77.00'	149 cf	<b>5.67'W x 10.50'L x 2.50'H Prismatic</b> Inside #1 170 cf Overall - 3.0" Wall Thickness = 149 cf
#3	79.50'	5 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> -Impervious
#4	81.00'	1,250 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) -Impervious
		1,470 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
81.00	2	0	0
81.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	76.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	81.00'	<b>20.0" Horiz. Orifice/Grate</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 7.29 hrs HW=76.51' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

**Primary OutFlow** Max=0.01 cfs @ 12.95 hrs HW=81.01' TW=0.00' (Dynamic Tailwater)

↑**2=Orifice/Grate** (Weir Controls 0.01 cfs @ 0.25 fps)

**Summary for Pond DW1b: Prop. Drywells**

Inflow Area = 1,640 sf, 100.00% Impervious, Inflow Depth = 4.26" for 10-yr event  
 Inflow = 0.17 cfs @ 12.08 hrs, Volume= 583 cf  
 Outflow = 0.00 cfs @ 8.40 hrs, Volume= 401 cf, Atten= 97%, Lag= 0.0 min  
 Discarded = 0.00 cfs @ 8.40 hrs, Volume= 401 cf  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 76.12' @ 16.05 hrs Surf.Area= 192 sf Storage= 338 cf

Plug-Flow detention time= 402.1 min calculated for 401 cf (69% of inflow)

**Patch-Sunnycrest**

Type III 24-hr 10-yr Rainfall=4.50"

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Center-of-Mass det. time= 305.4 min ( 1,055.2 - 749.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	73.50'	133 cf	<b>7.67'W x 12.50'L x 3.50'H Prismaoid</b> x 2 671 cf Overall - 339 cf Embedded = 332 cf x 40.0% Voids
#2	74.00'	298 cf	<b>5.67'W x 10.50'L x 2.50'H Prismaoid</b> x 2 Inside #1 339 cf Overall - 3.0" Wall Thickness = 298 cf
#3	76.50'	9 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> x 2 -Impervious
#4	78.00'	2,501 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) x 2 -Impervious
		2,940 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
78.00	2	0	0
78.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	73.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	78.00'	<b>20.0" Horiz. Orifice/Grate X 2.00</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 8.40 hrs HW=73.51' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=73.50' TW=0.00' (Dynamic Tailwater)↑**2=Orifice/Grate** ( Controls 0.00 cfs)**Summary for Pond DW2: Prop. Drywell**

Inflow Area = 820 sf, 100.00% Impervious, Inflow Depth = 4.26" for 10-yr event  
 Inflow = 0.08 cfs @ 12.08 hrs, Volume= 291 cf  
 Outflow = 0.00 cfs @ 8.40 hrs, Volume= 201 cf, Atten= 97%, Lag= 0.0 min  
 Discarded = 0.00 cfs @ 8.40 hrs, Volume= 201 cf  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 71.12' @ 16.05 hrs Surf.Area= 96 sf Storage= 169 cf

Plug-Flow detention time= 402.1 min calculated for 201 cf (69% of inflow)

Center-of-Mass det. time= 305.4 min ( 1,055.2 - 749.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	66 cf	<b>7.67'W x 12.50'L x 3.50'H Prismaoid</b> 336 cf Overall - 170 cf Embedded = 166 cf x 40.0% Voids
#2	69.00'	149 cf	<b>5.67'W x 10.50'L x 2.50'H Prismaoid</b> Inside #1 170 cf Overall - 3.0" Wall Thickness = 149 cf
#3	71.50'	5 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> -Impervious
#4	73.00'	1,250 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) -Impervious
		1,470 cf	Total Available Storage

**Patch-Sunnycrest**

Type III 24-hr 10-yr Rainfall=4.50"

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
73.00	2	0	0
73.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	68.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	73.00'	<b>20.0" Horiz. Orifice/Grate</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 8.40 hrs HW=68.51' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=68.50' TW=0.00' (Dynamic Tailwater)↑**2=Orifice/Grate** ( Controls 0.00 cfs)**Summary for Pond DW3a: Prop. Drywell**

Inflow Area = 820 sf, 100.00% Impervious, Inflow Depth = 4.26" for 10-yr event  
 Inflow = 0.08 cfs @ 12.08 hrs, Volume= 291 cf  
 Outflow = 0.00 cfs @ 8.40 hrs, Volume= 201 cf, Atten= 97%, Lag= 0.0 min  
 Discarded = 0.00 cfs @ 8.40 hrs, Volume= 201 cf  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 71.12' @ 16.05 hrs Surf.Area= 96 sf Storage= 169 cf

Plug-Flow detention time= 402.1 min calculated for 201 cf (69% of inflow)

Center-of-Mass det. time= 305.4 min ( 1,055.2 - 749.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	66 cf	<b>7.67'W x 12.50'L x 3.50'H Prismatic</b> 336 cf Overall - 170 cf Embedded = 166 cf x 40.0% Voids
#2	69.00'	149 cf	<b>5.67'W x 10.50'L x 2.50'H Prismatic</b> Inside #1 170 cf Overall - 3.0" Wall Thickness = 149 cf
#3	71.50'	5 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> -Impervious
#4	73.00'	1,250 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) -Impervious
		1,470 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
73.00	2	0	0
73.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	68.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	73.00'	<b>20.0" Horiz. Orifice/Grate</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

**Patch-Sunnycrest**

Type III 24-hr 10-yr Rainfall=4.50"

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**Discarded OutFlow** Max=0.00 cfs @ 8.40 hrs HW=68.51' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=68.50' TW=58.00' (Dynamic Tailwater)↑**2=Orifice/Grate** ( Controls 0.00 cfs)**Summary for Pond DW3b: Prop. Drywells**

Inflow Area = 1,640 sf, 100.00% Impervious, Inflow Depth = 4.26" for 10-yr event  
 Inflow = 0.17 cfs @ 12.08 hrs, Volume= 583 cf  
 Outflow = 0.00 cfs @ 8.40 hrs, Volume= 401 cf, Atten= 97%, Lag= 0.0 min  
 Discarded = 0.00 cfs @ 8.40 hrs, Volume= 401 cf  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 70.12' @ 16.05 hrs Surf.Area= 192 sf Storage= 338 cf

Plug-Flow detention time= 402.1 min calculated for 401 cf (69% of inflow)

Center-of-Mass det. time= 305.4 min ( 1,055.2 - 749.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	67.50'	133 cf	<b>7.67'W x 12.50'L x 3.50'H Prismatic</b> x 2 671 cf Overall - 339 cf Embedded = 332 cf x 40.0% Voids
#2	68.00'	298 cf	<b>5.67'W x 10.50'L x 2.50'H Prismatic</b> x 2 Inside #1 339 cf Overall - 3.0" Wall Thickness = 298 cf
#3	70.50'	9 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> x 2 -Impervious
#4	72.00'	2,501 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) x 2 -Impervious
		2,940 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
72.00	2	0	0
72.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	67.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	72.00'	<b>20.0" Horiz. Orifice/Grate X 2.00</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 8.40 hrs HW=67.51' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=67.50' TW=0.00' (Dynamic Tailwater)↑**2=Orifice/Grate** ( Controls 0.00 cfs)

**Summary for Pond WQS: Prop. - WQS**

Inflow Area = 35,683 sf, 65.22% Impervious, Inflow Depth = 3.37" for 10-yr event  
Inflow = 3.14 cfs @ 12.10 hrs, Volume= 10,021 cf  
Outflow = 3.14 cfs @ 12.11 hrs, Volume= 10,021 cf, Atten= 0%, Lag= 0.6 min  
Primary = 3.14 cfs @ 12.11 hrs, Volume= 10,021 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 75.19' @ 12.11 hrs

Flood Elev= 80.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	74.00'	<b>12.0" Round OUTFALL</b> L= 167.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 74.00' / 58.00' S= 0.0958 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

**Primary OutFlow** Max=3.14 cfs @ 12.11 hrs HW=75.19' TW=60.56' (Dynamic Tailwater)

↑**1=OUTFALL** (Inlet Controls 3.14 cfs @ 4.00 fps)



**Patch-Sunnycrest**

Type III 24-hr 25-yr Rainfall=5.40"

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**Summary for Subcatchment E1: Exist.-To North**

Runoff = 2.46 cfs @ 12.23 hrs, Volume= 10,435 cf, Depth= 2.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-yr Rainfall=5.40"

	Area (sf)	CN	Description
*	2,844	98	Existing Building & Stairs
*	2,112	98	Existing Driveways & Walkway
	10,098	74	>75% Grass cover, Good, HSG C
	31,544	70	Woods, Good, HSG C
	46,598	74	Weighted Average
	41,642		89.36% Pervious Area
	4,956		10.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	100	0.0500	0.11		<b>Sheet Flow, Woods - Sheet Flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.10"
1.2	124	0.1130	1.68		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b>
					Woodland Kv= 5.0 fps
16.3	224	Total			

**Summary for Subcatchment E2: Exist.-To West**

Runoff = 1.18 cfs @ 12.26 hrs, Volume= 5,227 cf, Depth= 2.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-yr Rainfall=5.40"

	Area (sf)	CN	Description
*	650	98	Ledge
	25,235	70	Woods, Good, HSG C
	25,885	71	Weighted Average
	25,235		97.49% Pervious Area
	650		2.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	100	0.0400	0.10		<b>Sheet Flow, Woods - Sheet Flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	136	0.0919	1.52		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b>
					Woodland Kv= 5.0 fps
18.0	236	Total			

**Patch-Sunnycrest**

Type III 24-hr 25-yr Rainfall=5.40"

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**Summary for Subcatchment E3: Exist.-To South**

Runoff = 4.27 cfs @ 12.22 hrs, Volume= 17,794 cf, Depth= 2.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-yr Rainfall=5.40"

	Area (sf)	CN	Description
*	1,260	98	Existing Building & Stairs
*	631	98	Existing Driveways & Walkway
	16,604	74	>75% Grass cover, Good, HSG C
	69,619	70	Woods, Good, HSG C
	88,114	71	Weighted Average
	86,223		97.85% Pervious Area
	1,891		2.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	65	0.0385	0.14		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"
5.7	35	0.0714	0.10		<b>Sheet Flow, Woods - Sheet Flow</b> Woods: Light underbrush n= 0.400 P2= 3.10"
1.7	194	0.1399	1.87		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b> Woodland Kv= 5.0 fps
15.3	294	Total			

**Summary for Subcatchment P-1c: Prop.-Half Exist. Building**

Runoff = 0.14 cfs @ 12.08 hrs, Volume= 490 cf, Depth= 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-yr Rainfall=5.40"

	Area (sf)	CN	Description
*	1,140	98	Lot 2 - Building Rear Roof
	1,140		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					<b>Direct Entry, Min. 6 Minutes</b>

**Summary for Subcatchment P-1d: Prop.-Overland To Berm**

Runoff = 0.61 cfs @ 12.10 hrs, Volume= 1,936 cf, Depth= 2.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-yr Rainfall=5.40"

**Patch-Sunnycrest**

Type III 24-hr 25-yr Rainfall=5.40"

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Area (sf)	CN	Description
8,647	74	>75% Grass cover, Good, HSG C
8,647		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.1400	0.25		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"

**Summary for Subcatchment P1a: Prop.-Building 2&3**

Runoff = 0.20 cfs @ 12.08 hrs, Volume= 706 cf, Depth= 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-yr Rainfall=5.40"

Area (sf)	CN	Description
* 820	98	Lot 2 - Building Rear Roof
* 820	98	Lot 3 - Building Rear Roof
1,640	98	Weighted Average
1,640		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					<b>Direct Entry, Min. 6 Minutes</b>

**Summary for Subcatchment P1b: Prop.-Overland Flow**

Runoff = 2.02 cfs @ 12.11 hrs, Volume= 6,577 cf, Depth= 2.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-yr Rainfall=5.40"

Area (sf)	CN	Description
* 1,601	98	Existing Building Roof
* 1,462	98	Existing Driveways, Walkway, Stairs
14,646	74	>75% Grass cover, Good, HSG C
10,706	70	Woods, Good, HSG C
28,415	75	Weighted Average
25,352		89.22% Pervious Area
3,063		10.78% Impervious Area

**Patch-Sunnycrest**

Type III 24-hr 25-yr Rainfall=5.40"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.1400	0.25		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"
0.2	21	0.0952	2.16		<b>Shallow Concentrated Flow, Grass - Conc. Flow</b> Short Grass Pasture Kv= 7.0 fps
0.5	49	0.0920	1.52		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b> Woodland Kv= 5.0 fps
7.4	170	Total			

**Summary for Subcatchment P2a: Prop.-Building 4**

Runoff = 0.10 cfs @ 12.08 hrs, Volume= 353 cf, Depth= 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-yr Rainfall=5.40"

Area (sf)	CN	Description
* 820	98	Lot 4 - Building Rear Roof
820		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					<b>Direct Entry, Min. 6 Minutes</b>

**Summary for Subcatchment P2b: Prop.-Overland Flow**

Runoff = 1.15 cfs @ 12.13 hrs, Volume= 3,956 cf, Depth= 2.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-yr Rainfall=5.40"

Area (sf)	CN	Description
10,095	74	>75% Grass cover, Good, HSG C
8,817	70	Woods, Good, HSG C
18,912	72	Weighted Average
18,912		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	78	0.1666	0.26		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"
3.5	22	0.0909	0.10		<b>Sheet Flow, Woods - Sheet Flow</b> Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	21	0.0714	1.34		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b> Woodland Kv= 5.0 fps
8.9	121	Total			

**Patch-Sunnycrest**

Type III 24-hr 25-yr Rainfall=5.40"

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**Summary for Subcatchment P3a: Prop.-Building 7**

Runoff = 0.10 cfs @ 12.08 hrs, Volume= 353 cf, Depth= 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-yr Rainfall=5.40"

Area (sf)	CN	Description
* 820	98	Lot 7 - Building Rear Roof
820		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. 6 Minutes

**Summary for Subcatchment P3b: Prop.-Building 5&6**

Runoff = 0.20 cfs @ 12.08 hrs, Volume= 706 cf, Depth= 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-yr Rainfall=5.40"

Area (sf)	CN	Description
* 820	98	Lot 5 - Building Rear Roof
* 820	98	Lot 6 - Building Rear Roof
1,640	98	Weighted Average
1,640		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. 6 Minutes

**Summary for Subcatchment P3c: Prop.-To CB1**

Runoff = 0.64 cfs @ 12.09 hrs, Volume= 2,036 cf, Depth= 4.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-yr Rainfall=5.40"

Area (sf)	CN	Description
* 635	98	Prop. Building & Stairs
* 2,932	98	Prop. Road, Driveway, Sidewalk & Walkway
2,312	74	>75% Grass cover, Good, HSG C
5,879	89	Weighted Average
2,312		39.33% Pervious Area
3,567		60.67% Impervious Area

**Patch-Sunnycrest**

Type III 24-hr 25-yr Rainfall=5.40"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	29	0.0200	0.09		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"
0.5	100	0.0320	3.63		<b>Shallow Concentrated Flow, Gutterline - Conc.Flow</b> Paved Kv= 20.3 fps
0.1					<b>Direct Entry, Min. 6 Minutes</b>
6.0	129	Total			

**Summary for Subcatchment P3d: Prop.-To CB2**

Runoff = 0.35 cfs @ 12.09 hrs, Volume= 1,107 cf, Depth= 4.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-yr Rainfall=5.40"

	Area (sf)	CN	Description
*	2,022	98	Prop. Road, Driveway & Walkway
	1,175	74	>75% Grass cover, Good, HSG C
	3,197	89	Weighted Average
	1,175		36.75% Pervious Area
	2,022		63.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	27	0.0550	0.13		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"
0.4	68	0.0250	3.21		<b>Shallow Concentrated Flow, Gutterline - Conc.Flow</b> Paved Kv= 20.3 fps
2.2					<b>Direct Entry, Min. 6 Minutes</b>
6.0	95	Total			

**Summary for Subcatchment P3e: Prop.-To CB3**

Runoff = 2.93 cfs @ 12.08 hrs, Volume= 9,452 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-yr Rainfall=5.40"

	Area (sf)	CN	Description
*	4,388	98	Prop. Building & Stairs
*	13,297	98	Prop. Road, Driveway, Sidewalk & Walkway
	8,922	74	>75% Grass cover, Good, HSG C
	26,607	90	Weighted Average
	8,922		33.53% Pervious Area
	17,685		66.47% Impervious Area

**Patch-Sunnycrest**

Type III 24-hr 25-yr Rainfall=5.40"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					<b>Direct Entry, Min. 6 Minutes</b>

**Summary for Subcatchment P3f: Prop.- Overland Flow to Det. Pond**

Runoff = 1.06 cfs @ 12.11 hrs, Volume= 3,459 cf, Depth= 2.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-yr Rainfall=5.40"

Area (sf)	CN	Description
* 242	98	Building Roof
* 208	98	Prop. Road
14,493	74	>75% Grass cover, Good, HSG C
14,943	75	Weighted Average
14,493		96.99% Pervious Area
450		3.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.1100	0.23		<b>Sheet Flow, Grass - Sheet Flow</b>
					Grass: Dense n= 0.240 P2= 3.10"
0.2	65	0.1690	6.17		<b>Shallow Concentrated Flow, Grass - Concentrated Flow</b>
					Grassed Waterway Kv= 15.0 fps
7.5	165	Total			

**Summary for Subcatchment P3g: Prop.- Overland Flow**

Runoff = 2.69 cfs @ 12.16 hrs, Volume= 10,028 cf, Depth= 2.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-yr Rainfall=5.40"

Area (sf)	CN	Description
* 40	98	Prop. Road
19,652	74	>75% Grass cover, Good, HSG C
28,245	70	Woods, Good, HSG C
47,937	72	Weighted Average
47,897		99.92% Pervious Area
40		0.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	100	0.0650	0.18		<b>Sheet Flow, Grass - Sheet Flow</b>
					Grass: Dense n= 0.240 P2= 3.10"
2.3	214	0.1000	1.58		<b>Shallow Concentrated Flow, Woods - Concentrated Flow</b>
					Woodland Kv= 5.0 fps
11.3	314	Total			

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Type III 24-hr 25-yr Rainfall=5.40"

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**Summary for Reach P1: Prop.-To North**

Inflow Area = 39,842 sf, 14.67% Impervious, Inflow Depth = 2.12" for 25-yr event  
 Inflow = 2.02 cfs @ 12.11 hrs, Volume= 7,032 cf  
 Outflow = 2.02 cfs @ 12.12 hrs, Volume= 7,032 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Summary for Reach P2: Prop.-To West**

Inflow Area = 19,732 sf, 4.16% Impervious, Inflow Depth = 2.41" for 25-yr event  
 Inflow = 1.15 cfs @ 12.13 hrs, Volume= 3,956 cf  
 Outflow = 1.15 cfs @ 12.14 hrs, Volume= 3,956 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Summary for Reach P3: Prop.-To South**

Inflow Area = 101,023 sf, 25.96% Impervious, Inflow Depth > 2.05" for 25-yr event  
 Inflow = 2.78 cfs @ 12.16 hrs, Volume= 17,281 cf  
 Outflow = 2.78 cfs @ 12.17 hrs, Volume= 17,281 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Summary for Pond BM: Bermed Area**

Inflow Area = 8,647 sf, 0.00% Impervious, Inflow Depth = 2.69" for 25-yr event  
 Inflow = 0.61 cfs @ 12.10 hrs, Volume= 1,936 cf  
 Outflow = 0.21 cfs @ 12.43 hrs, Volume= 1,604 cf, Atten= 66%, Lag= 20.1 min  
 Discarded = 0.04 cfs @ 12.43 hrs, Volume= 1,264 cf  
 Primary = 0.17 cfs @ 12.43 hrs, Volume= 340 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 68.01' @ 12.43 hrs Surf.Area= 1,596 sf Storage= 858 cf

Plug-Flow detention time= 341.8 min calculated for 1,604 cf (83% of inflow)

Center-of-Mass det. time= 270.4 min ( 1,104.7 - 834.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	66.00'	1,390 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
66.00	0	0	0
68.00	848	848	848
68.10	10,000	542	1,390
Device	Routing	Invert	Outlet Devices
#1	Discarded	66.00'	<b>1.020 in/hr Exfiltration over Surface area</b>
#2	Primary	68.00'	<b>91.0' long x 2.0' breadth Broad-Crested Rectangular Weir</b>
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00			



**Patch-Sunnycrest**

Type III 24-hr 25-yr Rainfall=5.40"

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2.50 3.00 3.50

Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88

2.85 3.07 3.20 3.32

**Discarded OutFlow** Max=0.04 cfs @ 12.43 hrs HW=68.01' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)**Primary OutFlow** Max=0.17 cfs @ 12.43 hrs HW=68.01' TW=0.00' (Dynamic Tailwater)↑**2=Broad-Crested Rectangular Weir** (Weir Controls 0.17 cfs @ 0.23 fps)**Summary for Pond CB1: Prop. - CB1**

Inflow Area = 5,879 sf, 60.67% Impervious, Inflow Depth = 4.16" for 25-yr event  
 Inflow = 0.64 cfs @ 12.09 hrs, Volume= 2,036 cf  
 Outflow = 0.64 cfs @ 12.10 hrs, Volume= 2,036 cf, Atten= 0%, Lag= 0.6 min  
 Primary = 0.64 cfs @ 12.10 hrs, Volume= 2,036 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 75.67' @ 12.13 hrs

Flood Elev= 77.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	74.80'	<b>12.0" Round RCP_Round 12"</b> L= 35.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 74.80' / 74.45' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.00 cfs @ 12.10 hrs HW=75.54' TW=75.55' (Dynamic Tailwater)↑**1=RCP\_Round 12"** (Controls 0.00 cfs)**Summary for Pond CB2: Prop. - CB2**

Inflow Area = 3,197 sf, 63.25% Impervious, Inflow Depth = 4.16" for 25-yr event  
 Inflow = 0.35 cfs @ 12.09 hrs, Volume= 1,107 cf  
 Outflow = 0.35 cfs @ 12.10 hrs, Volume= 1,107 cf, Atten= 0%, Lag= 0.6 min  
 Primary = 0.35 cfs @ 12.10 hrs, Volume= 1,107 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 76.60' @ 12.10 hrs

Flood Elev= 79.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	76.30'	<b>12.0" Round RCP_Round 12"</b> L= 12.2' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 76.30' / 76.15' S= 0.0123 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.34 cfs @ 12.10 hrs HW=76.60' TW=75.55' (Dynamic Tailwater)↑**1=RCP\_Round 12"** (Barrel Controls 0.34 cfs @ 2.61 fps)

**Patch-Sunnycrest**

Type III 24-hr 25-yr Rainfall=5.40"

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**Summary for Pond CB3: Prop. - CB3**

Inflow Area = 26,607 sf, 66.47% Impervious, Inflow Depth = 4.26" for 25-yr event  
 Inflow = 2.93 cfs @ 12.08 hrs, Volume= 9,452 cf  
 Outflow = 2.93 cfs @ 12.09 hrs, Volume= 9,452 cf, Atten= 0%, Lag= 0.6 min  
 Primary = 2.93 cfs @ 12.09 hrs, Volume= 9,452 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 76.55' @ 12.11 hrs  
 Flood Elev= 78.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	75.40'	<b>12.0" Round RCP_Round 12"</b> L= 140.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 75.40' / 74.00' S= 0.0100 '/ Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

**Primary OutFlow** Max=2.85 cfs @ 12.09 hrs HW=76.53' TW=75.54' (Dynamic Tailwater)  
 ↑1=RCP\_Round 12" (Outlet Controls 2.85 cfs @ 4.02 fps)

**Summary for Pond DM1: Prop. - DM1**

Inflow Area = 9,076 sf, 61.58% Impervious, Inflow Depth = 4.16" for 25-yr event  
 Inflow = 0.98 cfs @ 12.10 hrs, Volume= 3,143 cf  
 Outflow = 0.98 cfs @ 12.11 hrs, Volume= 3,143 cf, Atten= 0%, Lag= 0.6 min  
 Primary = 0.98 cfs @ 12.11 hrs, Volume= 3,143 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 75.63' @ 12.12 hrs  
 Flood Elev= 79.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	74.35'	<b>12.0" Round RCP_Round 12"</b> L= 37.2' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 74.35' / 74.00' S= 0.0094 '/ Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.79 cfs @ 12.11 hrs HW=75.61' TW=75.56' (Dynamic Tailwater)  
 ↑1=RCP\_Round 12" (Inlet Controls 0.79 cfs @ 1.01 fps)

**Summary for Pond DP: Detention Pond**

Inflow Area = 51,446 sf, 47.71% Impervious, Inflow Depth = 3.74" for 25-yr event  
 Inflow = 4.96 cfs @ 12.11 hrs, Volume= 16,054 cf  
 Outflow = 0.25 cfs @ 14.51 hrs, Volume= 12,243 cf, Atten= 95%, Lag= 144.3 min  
 Discarded = 0.08 cfs @ 14.51 hrs, Volume= 4,988 cf  
 Primary = 0.17 cfs @ 14.51 hrs, Volume= 7,255 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

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Type III 24-hr 25-yr Rainfall=5.40"

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Peak Elev= 62.75' @ 14.51 hrs Surf.Area= 3,367 sf Storage= 9,778 cf

Flood Elev= 64.00' Surf.Area= 4,173 sf Storage= 14,463 cf

Plug-Flow detention time= 427.0 min calculated for 12,243 cf (76% of inflow)

Center-of-Mass det. time= 343.2 min ( 1,142.7 - 799.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	14,463 cf	<b>Custom Stage Data (Conic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
58.00	914	0	0	914
60.00	1,834	2,695	2,695	1,870
62.00	2,920	4,712	7,407	3,009
64.00	4,173	7,056	14,463	4,330

Device	Routing	Invert	Outlet Devices
#1	Primary	56.50'	<b>12.0" Round Culvert</b> L= 43.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 56.50' / 54.00' S= 0.0575 ' / Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	59.25'	<b>1.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	60.25'	<b>1.0" Vert. Orifice/Grate</b> C= 0.600
#4	Device 1	61.25'	<b>1.2" Vert. Orifice/Grate</b> C= 0.600
#5	Device 1	62.25'	<b>1.5" Vert. Orifice/Grate</b> C= 0.600
#6	Device 1	63.25'	<b>30.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#7	Primary	63.50'	<b>8.0' long x 6.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#8	Discarded	58.00'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.08 cfs @ 14.51 hrs HW=62.75' (Free Discharge)↑ **8=Exfiltration** (Exfiltration Controls 0.08 cfs)**Primary OutFlow** Max=0.17 cfs @ 14.51 hrs HW=62.75' TW=0.00' (Dynamic Tailwater)

↑ **1=Culvert** (Passes 0.17 cfs of 9.07 cfs potential flow)

↑ **2=Orifice/Grate** (Orifice Controls 0.05 cfs @ 8.96 fps)

↑ **3=Orifice/Grate** (Orifice Controls 0.04 cfs @ 7.56 fps)

↑ **4=Orifice/Grate** (Orifice Controls 0.05 cfs @ 5.81 fps)

↑ **5=Orifice/Grate** (Orifice Controls 0.04 cfs @ 3.20 fps)

↑ **6=Orifice/Grate** ( Controls 0.00 cfs)

↑ **7=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

**Patch-Sunnycrest**

Type III 24-hr 25-yr Rainfall=5.40"

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**Summary for Pond DW1a: Prop. Drywells**

Inflow Area = 1,140 sf, 100.00% Impervious, Inflow Depth = 5.16" for 25-yr event  
 Inflow = 0.14 cfs @ 12.08 hrs, Volume= 490 cf  
 Outflow = 0.04 cfs @ 12.41 hrs, Volume= 331 cf, Atten= 71%, Lag= 19.5 min  
 Discarded = 0.00 cfs @ 6.55 hrs, Volume= 215 cf  
 Primary = 0.04 cfs @ 12.41 hrs, Volume= 116 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 81.02' @ 12.41 hrs Surf.Area= 96 sf Storage= 226 cf

Plug-Flow detention time= 288.2 min calculated for 331 cf (67% of inflow)  
 Center-of-Mass det. time= 188.7 min ( 935.4 - 746.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	76.50'	66 cf	<b>7.67'W x 12.50'L x 3.50'H Prismatic</b> 336 cf Overall - 170 cf Embedded = 166 cf x 40.0% Voids
#2	77.00'	149 cf	<b>5.67'W x 10.50'L x 2.50'H Prismatic</b> Inside #1 170 cf Overall - 3.0" Wall Thickness = 149 cf
#3	79.50'	5 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> -Impervious
#4	81.00'	1,250 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) -Impervious
		1,470 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
81.00	2	0	0
81.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	76.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	81.00'	<b>20.0" Horiz. Orifice/Grate</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 6.55 hrs HW=76.51' (Free Discharge)  
 ↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

**Primary OutFlow** Max=0.04 cfs @ 12.41 hrs HW=81.02' TW=0.00' (Dynamic Tailwater)  
 ↑**2=Orifice/Grate** (Weir Controls 0.04 cfs @ 0.43 fps)

**Summary for Pond DW1b: Prop. Drywells**

Inflow Area = 1,640 sf, 100.00% Impervious, Inflow Depth = 5.16" for 25-yr event  
 Inflow = 0.20 cfs @ 12.08 hrs, Volume= 706 cf  
 Outflow = 0.00 cfs @ 7.74 hrs, Volume= 414 cf, Atten= 98%, Lag= 0.0 min  
 Discarded = 0.00 cfs @ 7.74 hrs, Volume= 414 cf  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 77.29' @ 16.87 hrs Surf.Area= 192 sf Storage= 435 cf

Plug-Flow detention time= 399.2 min calculated for 414 cf (59% of inflow)

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Type III 24-hr 25-yr Rainfall=5.40"

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Center-of-Mass det. time= 285.7 min ( 1,032.5 - 746.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	73.50'	133 cf	<b>7.67'W x 12.50'L x 3.50'H Prismaoid</b> x 2 671 cf Overall - 339 cf Embedded = 332 cf x 40.0% Voids
#2	74.00'	298 cf	<b>5.67'W x 10.50'L x 2.50'H Prismaoid</b> x 2 Inside #1 339 cf Overall - 3.0" Wall Thickness = 298 cf
#3	76.50'	9 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> x 2 -Impervious
#4	78.00'	2,501 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) x 2 -Impervious
		2,940 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
78.00	2	0	0
78.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	73.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	78.00'	<b>20.0" Horiz. Orifice/Grate X 2.00</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 7.74 hrs HW=73.51' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=73.50' TW=0.00' (Dynamic Tailwater)↑**2=Orifice/Grate** ( Controls 0.00 cfs)**Summary for Pond DW2: Prop. Drywell**

Inflow Area = 820 sf, 100.00% Impervious, Inflow Depth = 5.16" for 25-yr event  
 Inflow = 0.10 cfs @ 12.08 hrs, Volume= 353 cf  
 Outflow = 0.00 cfs @ 7.74 hrs, Volume= 207 cf, Atten= 98%, Lag= 0.0 min  
 Discarded = 0.00 cfs @ 7.74 hrs, Volume= 207 cf  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 72.29' @ 16.87 hrs Surf.Area= 96 sf Storage= 218 cf

Plug-Flow detention time= 399.2 min calculated for 207 cf (59% of inflow)

Center-of-Mass det. time= 285.7 min ( 1,032.5 - 746.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	66 cf	<b>7.67'W x 12.50'L x 3.50'H Prismaoid</b> 336 cf Overall - 170 cf Embedded = 166 cf x 40.0% Voids
#2	69.00'	149 cf	<b>5.67'W x 10.50'L x 2.50'H Prismaoid</b> Inside #1 170 cf Overall - 3.0" Wall Thickness = 149 cf
#3	71.50'	5 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> -Impervious
#4	73.00'	1,250 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) -Impervious
		1,470 cf	Total Available Storage

**Patch-Sunnycrest**

Type III 24-hr 25-yr Rainfall=5.40"

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
73.00	2	0	0
73.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	68.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	73.00'	<b>20.0" Horiz. Orifice/Grate</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 7.74 hrs HW=68.51' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=68.50' TW=0.00' (Dynamic Tailwater)↑**2=Orifice/Grate** ( Controls 0.00 cfs)**Summary for Pond DW3a: Prop. Drywell**

Inflow Area = 820 sf, 100.00% Impervious, Inflow Depth = 5.16" for 25-yr event  
 Inflow = 0.10 cfs @ 12.08 hrs, Volume= 353 cf  
 Outflow = 0.00 cfs @ 7.74 hrs, Volume= 207 cf, Atten= 98%, Lag= 0.0 min  
 Discarded = 0.00 cfs @ 7.74 hrs, Volume= 207 cf  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 72.29' @ 16.87 hrs Surf.Area= 96 sf Storage= 218 cf

Plug-Flow detention time= 399.2 min calculated for 207 cf (59% of inflow)

Center-of-Mass det. time= 285.7 min ( 1,032.5 - 746.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	66 cf	<b>7.67'W x 12.50'L x 3.50'H Prismatic</b> 336 cf Overall - 170 cf Embedded = 166 cf x 40.0% Voids
#2	69.00'	149 cf	<b>5.67'W x 10.50'L x 2.50'H Prismatic</b> Inside #1 170 cf Overall - 3.0" Wall Thickness = 149 cf
#3	71.50'	5 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> -Impervious
#4	73.00'	1,250 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) -Impervious
		1,470 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
73.00	2	0	0
73.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	68.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	73.00'	<b>20.0" Horiz. Orifice/Grate</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

**Patch-Sunnycrest**

Type III 24-hr 25-yr Rainfall=5.40"

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**Discarded OutFlow** Max=0.00 cfs @ 7.74 hrs HW=68.51' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=68.50' TW=58.00' (Dynamic Tailwater)↑**2=Orifice/Grate** ( Controls 0.00 cfs)**Summary for Pond DW3b: Prop. Drywells**

Inflow Area = 1,640 sf, 100.00% Impervious, Inflow Depth = 5.16" for 25-yr event  
 Inflow = 0.20 cfs @ 12.08 hrs, Volume= 706 cf  
 Outflow = 0.00 cfs @ 7.74 hrs, Volume= 414 cf, Atten= 98%, Lag= 0.0 min  
 Discarded = 0.00 cfs @ 7.74 hrs, Volume= 414 cf  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 71.29' @ 16.87 hrs Surf.Area= 192 sf Storage= 435 cf

Plug-Flow detention time= 399.2 min calculated for 414 cf (59% of inflow)

Center-of-Mass det. time= 285.7 min ( 1,032.5 - 746.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	67.50'	133 cf	<b>7.67'W x 12.50'L x 3.50'H Prismatic</b> x 2 671 cf Overall - 339 cf Embedded = 332 cf x 40.0% Voids
#2	68.00'	298 cf	<b>5.67'W x 10.50'L x 2.50'H Prismatic</b> x 2 Inside #1 339 cf Overall - 3.0" Wall Thickness = 298 cf
#3	70.50'	9 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> x 2 -Impervious
#4	72.00'	2,501 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) x 2 -Impervious
		2,940 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
72.00	2	0	0
72.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	67.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	72.00'	<b>20.0" Horiz. Orifice/Grate X 2.00</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 7.74 hrs HW=67.51' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=67.50' TW=0.00' (Dynamic Tailwater)↑**2=Orifice/Grate** ( Controls 0.00 cfs)

**Patch-Sunnycrest**

Type III 24-hr 25-yr Rainfall=5.40"

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**Summary for Pond WQS: Prop. - WQS**

Inflow Area = 35,683 sf, 65.22% Impervious, Inflow Depth = 4.24" for 25-yr event  
Inflow = 3.91 cfs @ 12.10 hrs, Volume= 12,595 cf  
Outflow = 3.91 cfs @ 12.11 hrs, Volume= 12,595 cf, Atten= 0%, Lag= 0.6 min  
Primary = 3.91 cfs @ 12.11 hrs, Volume= 12,595 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 75.57' @ 12.11 hrs

Flood Elev= 80.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	74.00'	<b>12.0" Round OUTFALL</b> L= 167.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 74.00' / 58.00' S= 0.0958 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

**Primary OutFlow** Max=3.90 cfs @ 12.11 hrs HW=75.56' TW=61.14' (Dynamic Tailwater)↑**1=OUTFALL** (Inlet Controls 3.90 cfs @ 4.97 fps)



**Patch-Sunnycrest**

Type III 24-hr 100-yr Rainfall=6.50"

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**Summary for Subcatchment E1: Exist.-To North**

Runoff = 3.32 cfs @ 12.22 hrs, Volume= 14,017 cf, Depth= 3.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-yr Rainfall=6.50"

	Area (sf)	CN	Description
*	2,844	98	Existing Building & Stairs
*	2,112	98	Existing Driveways & Walkway
	10,098	74	>75% Grass cover, Good, HSG C
	31,544	70	Woods, Good, HSG C
	46,598	74	Weighted Average
	41,642		89.36% Pervious Area
	4,956		10.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	100	0.0500	0.11		<b>Sheet Flow, Woods - Sheet Flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.10"
1.2	124	0.1130	1.68		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b>
					Woodland Kv= 5.0 fps
16.3	224	Total			

**Summary for Subcatchment E2: Exist.-To West**

Runoff = 1.62 cfs @ 12.26 hrs, Volume= 7,133 cf, Depth= 3.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-yr Rainfall=6.50"

	Area (sf)	CN	Description
*	650	98	Ledge
	25,235	70	Woods, Good, HSG C
	25,885	71	Weighted Average
	25,235		97.49% Pervious Area
	650		2.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	100	0.0400	0.10		<b>Sheet Flow, Woods - Sheet Flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	136	0.0919	1.52		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b>
					Woodland Kv= 5.0 fps
18.0	236	Total			

**Patch-Sunnycrest**

Type III 24-hr 100-yr Rainfall=6.50"

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**Summary for Subcatchment E3: Exist.-To South**

Runoff = 5.87 cfs @ 12.22 hrs, Volume= 24,280 cf, Depth= 3.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-yr Rainfall=6.50"

	Area (sf)	CN	Description
*	1,260	98	Existing Building & Stairs
*	631	98	Existing Driveways & Walkway
	16,604	74	>75% Grass cover, Good, HSG C
	69,619	70	Woods, Good, HSG C
	88,114	71	Weighted Average
	86,223		97.85% Pervious Area
	1,891		2.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	65	0.0385	0.14		<b>Sheet Flow, Grass - Sheet Flow</b>
					Grass: Dense n= 0.240 P2= 3.10"
5.7	35	0.0714	0.10		<b>Sheet Flow, Woods - Sheet Flow</b>
					Woods: Light underbrush n= 0.400 P2= 3.10"
1.7	194	0.1399	1.87		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b>
					Woodland Kv= 5.0 fps
15.3	294	Total			

**Summary for Subcatchment P-1c: Prop.-Half Exist. Building**

Runoff = 0.17 cfs @ 12.08 hrs, Volume= 595 cf, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-yr Rainfall=6.50"

	Area (sf)	CN	Description
*	1,140	98	Lot 2 - Building Rear Roof
	1,140		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					<b>Direct Entry, Min. 6 Minutes</b>

**Summary for Subcatchment P-1d: Prop.-Overland To Berm**

Runoff = 0.82 cfs @ 12.10 hrs, Volume= 2,601 cf, Depth= 3.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-yr Rainfall=6.50"

**Patch-Sunnycrest**

Type III 24-hr 100-yr Rainfall=6.50"

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Area (sf)	CN	Description
8,647	74	>75% Grass cover, Good, HSG C
8,647		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.1400	0.25		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"

**Summary for Subcatchment P1a: Prop.-Building 2&3**

Runoff = 0.24 cfs @ 12.08 hrs, Volume= 856 cf, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
* 820	98	Lot 2 - Building Rear Roof
* 820	98	Lot 3 - Building Rear Roof
1,640	98	Weighted Average
1,640		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					<b>Direct Entry, Min. 6 Minutes</b>

**Summary for Subcatchment P1b: Prop.-Overland Flow**

Runoff = 2.70 cfs @ 12.11 hrs, Volume= 8,790 cf, Depth= 3.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
* 1,601	98	Existing Building Roof
* 1,462	98	Existing Driveways, Walkway, Stairs
14,646	74	>75% Grass cover, Good, HSG C
10,706	70	Woods, Good, HSG C
28,415	75	Weighted Average
25,352		89.22% Pervious Area
3,063		10.78% Impervious Area

**Patch-Sunnycrest**

Type III 24-hr 100-yr Rainfall=6.50"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	100	0.1400	0.25		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"
0.2	21	0.0952	2.16		<b>Shallow Concentrated Flow, Grass - Conc. Flow</b> Short Grass Pasture Kv= 7.0 fps
0.5	49	0.0920	1.52		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b> Woodland Kv= 5.0 fps
7.4	170	Total			

**Summary for Subcatchment P2a: Prop.-Building 4**

Runoff = 0.12 cfs @ 12.08 hrs, Volume= 428 cf, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
* 820	98	Lot 4 - Building Rear Roof
820		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					<b>Direct Entry, Min. 6 Minutes</b>

**Summary for Subcatchment P2b: Prop.-Overland Flow**

Runoff = 1.57 cfs @ 12.13 hrs, Volume= 5,369 cf, Depth= 3.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
10,095	74	>75% Grass cover, Good, HSG C
8,817	70	Woods, Good, HSG C
18,912	72	Weighted Average
18,912		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	78	0.1666	0.26		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"
3.5	22	0.0909	0.10		<b>Sheet Flow, Woods - Sheet Flow</b> Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	21	0.0714	1.34		<b>Shallow Concentrated Flow, Woods - Conc.Flow</b> Woodland Kv= 5.0 fps
8.9	121	Total			

**Patch-Sunnycrest**

Type III 24-hr 100-yr Rainfall=6.50"

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**Summary for Subcatchment P3a: Prop.-Building 7**

Runoff = 0.12 cfs @ 12.08 hrs, Volume= 428 cf, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
* 820	98	Lot 7 - Building Rear Roof
820		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. 6 Minutes

**Summary for Subcatchment P3b: Prop.-Building 5&6**

Runoff = 0.24 cfs @ 12.08 hrs, Volume= 856 cf, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
* 820	98	Lot 5 - Building Rear Roof
* 820	98	Lot 6 - Building Rear Roof
1,640	98	Weighted Average
1,640		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. 6 Minutes

**Summary for Subcatchment P3c: Prop.-To CB1**

Runoff = 0.79 cfs @ 12.08 hrs, Volume= 2,558 cf, Depth= 5.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
* 635	98	Prop. Building & Stairs
* 2,932	98	Prop. Road, Driveway, Sidewalk & Walkway
2,312	74	>75% Grass cover, Good, HSG C
5,879	89	Weighted Average
2,312		39.33% Pervious Area
3,567		60.67% Impervious Area

**Patch-Sunnycrest**

Type III 24-hr 100-yr Rainfall=6.50"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	29	0.0200	0.09		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"
0.5	100	0.0320	3.63		<b>Shallow Concentrated Flow, Gutterline - Conc.Flow</b> Paved Kv= 20.3 fps
0.1					<b>Direct Entry, Min. 6 Minutes</b>
6.0	129	Total			

**Summary for Subcatchment P3d: Prop.-To CB2**

Runoff = 0.43 cfs @ 12.08 hrs, Volume= 1,391 cf, Depth= 5.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-yr Rainfall=6.50"

	Area (sf)	CN	Description
*	2,022	98	Prop. Road, Driveway & Walkway
	1,175	74	>75% Grass cover, Good, HSG C
	3,197	89	Weighted Average
	1,175		36.75% Pervious Area
	2,022		63.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	27	0.0550	0.13		<b>Sheet Flow, Grass - Sheet Flow</b> Grass: Dense n= 0.240 P2= 3.10"
0.4	68	0.0250	3.21		<b>Shallow Concentrated Flow, Gutterline - Conc.Flow</b> Paved Kv= 20.3 fps
2.2					<b>Direct Entry, Min. 6 Minutes</b>
6.0	95	Total			

**Summary for Subcatchment P3e: Prop.-To CB3**

Runoff = 3.62 cfs @ 12.08 hrs, Volume= 11,826 cf, Depth= 5.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-yr Rainfall=6.50"

	Area (sf)	CN	Description
*	4,388	98	Prop. Building & Stairs
*	13,297	98	Prop. Road, Driveway, Sidewalk & Walkway
	8,922	74	>75% Grass cover, Good, HSG C
	26,607	90	Weighted Average
	8,922		33.53% Pervious Area
	17,685		66.47% Impervious Area

**Patch-Sunnycrest**

Type III 24-hr 100-yr Rainfall=6.50"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					<b>Direct Entry, Min. 6 Minutes</b>

**Summary for Subcatchment P3f: Prop.- Overland Flow to Det. Pond**

Runoff = 1.42 cfs @ 12.11 hrs, Volume= 4,623 cf, Depth= 3.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
* 242	98	Building Roof
* 208	98	Prop. Road
14,493	74	>75% Grass cover, Good, HSG C
14,943	75	Weighted Average
14,493		96.99% Pervious Area
450		3.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.1100	0.23		<b>Sheet Flow, Grass - Sheet Flow</b>
					Grass: Dense n= 0.240 P2= 3.10"
0.2	65	0.1690	6.17		<b>Shallow Concentrated Flow, Grass - Concentrated Flow</b>
					Grassed Waterway Kv= 15.0 fps
7.5	165	Total			

**Summary for Subcatchment P3g: Prop.- Overland Flow**

Runoff = 3.68 cfs @ 12.16 hrs, Volume= 13,610 cf, Depth= 3.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
* 40	98	Prop. Road
19,652	74	>75% Grass cover, Good, HSG C
28,245	70	Woods, Good, HSG C
47,937	72	Weighted Average
47,897		99.92% Pervious Area
40		0.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	100	0.0650	0.18		<b>Sheet Flow, Grass - Sheet Flow</b>
					Grass: Dense n= 0.240 P2= 3.10"
2.3	214	0.1000	1.58		<b>Shallow Concentrated Flow, Woods - Concentrated Flow</b>
					Woodland Kv= 5.0 fps
11.3	314	Total			

**Patch-Sunnycrest**

Type III 24-hr 100-yr Rainfall=6.50"

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**Summary for Reach P1: Prop.-To North**

Inflow Area = 39,842 sf, 14.67% Impervious, Inflow Depth = 3.00" for 100-yr event  
 Inflow = 2.70 cfs @ 12.11 hrs, Volume= 9,969 cf  
 Outflow = 2.70 cfs @ 12.12 hrs, Volume= 9,969 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Summary for Reach P2: Prop.-To West**

Inflow Area = 19,732 sf, 4.16% Impervious, Inflow Depth = 3.30" for 100-yr event  
 Inflow = 1.57 cfs @ 12.13 hrs, Volume= 5,429 cf  
 Outflow = 1.57 cfs @ 12.14 hrs, Volume= 5,429 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Summary for Reach P3: Prop.-To South**

Inflow Area = 101,023 sf, 25.96% Impervious, Inflow Depth > 2.87" for 100-yr event  
 Inflow = 3.80 cfs @ 12.16 hrs, Volume= 24,172 cf  
 Outflow = 3.80 cfs @ 12.17 hrs, Volume= 24,172 cf, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Summary for Pond BM: Bermed Area**

Inflow Area = 8,647 sf, 0.00% Impervious, Inflow Depth = 3.61" for 100-yr event  
 Inflow = 0.82 cfs @ 12.10 hrs, Volume= 2,601 cf  
 Outflow = 0.58 cfs @ 12.19 hrs, Volume= 2,223 cf, Atten= 29%, Lag= 5.4 min  
 Discarded = 0.06 cfs @ 12.19 hrs, Volume= 1,371 cf  
 Primary = 0.52 cfs @ 12.19 hrs, Volume= 853 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 68.02' @ 12.19 hrs Surf.Area= 2,429 sf Storage= 876 cf

Plug-Flow detention time= 258.4 min calculated for 2,223 cf (85% of inflow)

Center-of-Mass det. time= 195.0 min ( 1,020.8 - 825.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	66.00'	1,390 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
66.00	0	0	0
68.00	848	848	848
68.10	10,000	542	1,390
Device	Routing	Invert	Outlet Devices
#1	Discarded	66.00'	<b>1.020 in/hr Exfiltration over Surface area</b>
#2	Primary	68.00'	<b>91.0' long x 2.0' breadth Broad-Crested Rectangular Weir</b>
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00			



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Type III 24-hr 100-yr Rainfall=6.50"

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2.50 3.00 3.50

Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88

2.85 3.07 3.20 3.32

**Discarded OutFlow** Max=0.06 cfs @ 12.19 hrs HW=68.02' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.06 cfs)**Primary OutFlow** Max=0.52 cfs @ 12.19 hrs HW=68.02' TW=0.00' (Dynamic Tailwater)↑**2=Broad-Crested Rectangular Weir** (Weir Controls 0.52 cfs @ 0.33 fps)**Summary for Pond CB1: Prop. - CB1**

Inflow Area = 5,879 sf, 60.67% Impervious, Inflow Depth = 5.22" for 100-yr event

Inflow = 0.79 cfs @ 12.08 hrs, Volume= 2,558 cf

Outflow = 0.79 cfs @ 12.09 hrs, Volume= 2,558 cf, Atten= 0%, Lag= 0.6 min

Primary = 0.79 cfs @ 12.09 hrs, Volume= 2,558 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 76.27' @ 12.13 hrs

Flood Elev= 77.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	74.80'	<b>12.0" Round RCP_Round 12"</b> L= 35.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 74.80' / 74.45' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.00 cfs @ 12.09 hrs HW=76.02' TW=76.11' (Dynamic Tailwater)↑**1=RCP\_Round 12"** (Controls 0.00 cfs)**Summary for Pond CB2: Prop. - CB2**

Inflow Area = 3,197 sf, 63.25% Impervious, Inflow Depth = 5.22" for 100-yr event

Inflow = 0.43 cfs @ 12.08 hrs, Volume= 1,391 cf

Outflow = 0.43 cfs @ 12.09 hrs, Volume= 1,391 cf, Atten= 0%, Lag= 0.6 min

Primary = 0.43 cfs @ 12.09 hrs, Volume= 1,391 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 76.64' @ 12.09 hrs

Flood Elev= 79.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	76.30'	<b>12.0" Round RCP_Round 12"</b> L= 12.2' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 76.30' / 76.15' S= 0.0123 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.43 cfs @ 12.09 hrs HW=76.64' TW=76.11' (Dynamic Tailwater)↑**1=RCP\_Round 12"** (Barrel Controls 0.43 cfs @ 2.72 fps)

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**Summary for Pond CB3: Prop. - CB3**

Inflow Area = 26,607 sf, 66.47% Impervious, Inflow Depth = 5.33" for 100-yr event  
 Inflow = 3.62 cfs @ 12.08 hrs, Volume= 11,826 cf  
 Outflow = 3.62 cfs @ 12.09 hrs, Volume= 11,826 cf, Atten= 0%, Lag= 0.6 min  
 Primary = 3.62 cfs @ 12.09 hrs, Volume= 11,826 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 77.61' @ 12.11 hrs  
 Flood Elev= 78.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	75.40'	<b>12.0" Round RCP_Round 12"</b> L= 140.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 75.40' / 74.00' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

**Primary OutFlow** Max=3.51 cfs @ 12.09 hrs HW=77.53' TW=76.09' (Dynamic Tailwater)  
 ↑1=RCP\_Round 12" (Outlet Controls 3.51 cfs @ 4.47 fps)

**Summary for Pond DM1: Prop. - DM1**

Inflow Area = 9,076 sf, 61.58% Impervious, Inflow Depth = 5.22" for 100-yr event  
 Inflow = 1.22 cfs @ 12.09 hrs, Volume= 3,949 cf  
 Outflow = 1.22 cfs @ 12.10 hrs, Volume= 3,949 cf, Atten= 0%, Lag= 0.6 min  
 Primary = 1.22 cfs @ 12.10 hrs, Volume= 3,949 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 76.23' @ 12.12 hrs  
 Flood Elev= 79.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	74.35'	<b>12.0" Round RCP_Round 12"</b> L= 37.2' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 74.35' / 74.00' S= 0.0094 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.98 cfs @ 12.10 hrs HW=76.19' TW=76.13' (Dynamic Tailwater)  
 ↑1=RCP\_Round 12" (Inlet Controls 0.98 cfs @ 1.25 fps)

**Summary for Pond DP: Detention Pond**

Inflow Area = 51,446 sf, 47.71% Impervious, Inflow Depth = 4.77" for 100-yr event  
 Inflow = 6.25 cfs @ 12.11 hrs, Volume= 20,457 cf  
 Outflow = 0.65 cfs @ 12.91 hrs, Volume= 15,959 cf, Atten= 90%, Lag= 48.5 min  
 Discarded = 0.09 cfs @ 12.91 hrs, Volume= 5,514 cf  
 Primary = 0.56 cfs @ 12.91 hrs, Volume= 10,445 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

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Peak Elev= 63.31' @ 12.91 hrs Surf.Area= 3,714 sf Storage= 11,732 cf

Flood Elev= 64.00' Surf.Area= 4,173 sf Storage= 14,463 cf

Plug-Flow detention time= 399.1 min calculated for 15,959 cf (78% of inflow)

Center-of-Mass det. time= 319.1 min ( 1,112.6 - 793.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	14,463 cf	<b>Custom Stage Data (Conic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
58.00	914	0	0	914
60.00	1,834	2,695	2,695	1,870
62.00	2,920	4,712	7,407	3,009
64.00	4,173	7,056	14,463	4,330

Device	Routing	Invert	Outlet Devices
#1	Primary	56.50'	<b>12.0" Round Culvert</b> L= 43.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 56.50' / 54.00' S= 0.0575 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	59.25'	<b>1.0" Vert. Orifice/Grate</b> C= 0.600
#3	Device 1	60.25'	<b>1.0" Vert. Orifice/Grate</b> C= 0.600
#4	Device 1	61.25'	<b>1.2" Vert. Orifice/Grate</b> C= 0.600
#5	Device 1	62.25'	<b>1.5" Vert. Orifice/Grate</b> C= 0.600
#6	Device 1	63.25'	<b>30.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#7	Primary	63.50'	<b>8.0' long x 6.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#8	Discarded	58.00'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.09 cfs @ 12.91 hrs HW=63.31' (Free Discharge)↑**8=Exfiltration** (Exfiltration Controls 0.09 cfs)**Primary OutFlow** Max=0.56 cfs @ 12.91 hrs HW=63.31' TW=0.00' (Dynamic Tailwater)

↑**1=Culvert** (Passes 0.56 cfs of 9.50 cfs potential flow)

↑**2=Orifice/Grate** (Orifice Controls 0.05 cfs @ 9.65 fps)

↑**3=Orifice/Grate** (Orifice Controls 0.05 cfs @ 8.36 fps)

↑**4=Orifice/Grate** (Orifice Controls 0.05 cfs @ 6.82 fps)

↑**5=Orifice/Grate** (Orifice Controls 0.06 cfs @ 4.80 fps)

↑**6=Orifice/Grate** (Weir Controls 0.35 cfs @ 0.78 fps)

↑**7=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

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**Summary for Pond DW1a: Prop. Drywells**

Inflow Area = 1,140 sf, 100.00% Impervious, Inflow Depth = 6.26" for 100-yr event  
 Inflow = 0.17 cfs @ 12.08 hrs, Volume= 595 cf  
 Outflow = 0.08 cfs @ 12.24 hrs, Volume= 429 cf, Atten= 51%, Lag= 9.2 min  
 Discarded = 0.00 cfs @ 5.56 hrs, Volume= 222 cf  
 Primary = 0.08 cfs @ 12.24 hrs, Volume= 207 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 81.03' @ 12.24 hrs Surf.Area= 96 sf Storage= 235 cf

Plug-Flow detention time= 239.9 min calculated for 429 cf (72% of inflow)  
 Center-of-Mass det. time= 147.3 min ( 891.3 - 744.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	76.50'	66 cf	<b>7.67'W x 12.50'L x 3.50'H Prismatic</b> 336 cf Overall - 170 cf Embedded = 166 cf x 40.0% Voids
#2	77.00'	149 cf	<b>5.67'W x 10.50'L x 2.50'H Prismatic</b> Inside #1 170 cf Overall - 3.0" Wall Thickness = 149 cf
#3	79.50'	5 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> -Impervious
#4	81.00'	1,250 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) -Impervious
		1,470 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
81.00	2	0	0
81.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	76.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	81.00'	<b>20.0" Horiz. Orifice/Grate</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 5.56 hrs HW=76.51' (Free Discharge)  
 ↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

**Primary OutFlow** Max=0.08 cfs @ 12.24 hrs HW=81.03' TW=0.00' (Dynamic Tailwater)  
 ↑**2=Orifice/Grate** (Weir Controls 0.08 cfs @ 0.54 fps)

**Summary for Pond DW1b: Prop. Drywells**

Inflow Area = 1,640 sf, 100.00% Impervious, Inflow Depth = 6.26" for 100-yr event  
 Inflow = 0.24 cfs @ 12.08 hrs, Volume= 856 cf  
 Outflow = 0.03 cfs @ 12.66 hrs, Volume= 546 cf, Atten= 88%, Lag= 34.8 min  
 Discarded = 0.00 cfs @ 6.93 hrs, Volume= 427 cf  
 Primary = 0.02 cfs @ 12.66 hrs, Volume= 119 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 78.01' @ 12.66 hrs Surf.Area= 192 sf Storage= 446 cf

Plug-Flow detention time= 332.8 min calculated for 546 cf (64% of inflow)

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Center-of-Mass det. time= 226.9 min ( 970.9 - 744.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	73.50'	133 cf	<b>7.67'W x 12.50'L x 3.50'H Prismaoid</b> x 2 671 cf Overall - 339 cf Embedded = 332 cf x 40.0% Voids
#2	74.00'	298 cf	<b>5.67'W x 10.50'L x 2.50'H Prismaoid</b> x 2 Inside #1 339 cf Overall - 3.0" Wall Thickness = 298 cf
#3	76.50'	9 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> x 2 -Impervious
#4	78.00'	2,501 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) x 2 -Impervious
		2,940 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
78.00	2	0	0
78.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	73.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	78.00'	<b>20.0" Horiz. Orifice/Grate X 2.00</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 6.93 hrs HW=73.51' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.02 cfs @ 12.66 hrs HW=78.01' TW=0.00' (Dynamic Tailwater)↑**2=Orifice/Grate** (Weir Controls 0.02 cfs @ 0.37 fps)**Summary for Pond DW2: Prop. Drywell**

Inflow Area = 820 sf, 100.00% Impervious, Inflow Depth = 6.26" for 100-yr event  
 Inflow = 0.12 cfs @ 12.08 hrs, Volume= 428 cf  
 Outflow = 0.02 cfs @ 12.61 hrs, Volume= 273 cf, Atten= 87%, Lag= 31.6 min  
 Discarded = 0.00 cfs @ 6.93 hrs, Volume= 214 cf  
 Primary = 0.01 cfs @ 12.61 hrs, Volume= 60 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 73.01' @ 12.61 hrs Surf.Area= 96 sf Storage= 221 cf

Plug-Flow detention time= 332.3 min calculated for 273 cf (64% of inflow)

Center-of-Mass det. time= 226.4 min ( 970.4 - 744.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	66 cf	<b>7.67'W x 12.50'L x 3.50'H Prismaoid</b> 336 cf Overall - 170 cf Embedded = 166 cf x 40.0% Voids
#2	69.00'	149 cf	<b>5.67'W x 10.50'L x 2.50'H Prismaoid</b> Inside #1 170 cf Overall - 3.0" Wall Thickness = 149 cf
#3	71.50'	5 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> -Impervious
#4	73.00'	1,250 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) -Impervious
		1,470 cf	Total Available Storage

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
73.00	2	0	0
73.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	68.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	73.00'	<b>20.0" Horiz. Orifice/Grate</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 6.93 hrs HW=68.51' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.01 cfs @ 12.61 hrs HW=73.01' TW=0.00' (Dynamic Tailwater)↑**2=Orifice/Grate** (Weir Controls 0.01 cfs @ 0.30 fps)**Summary for Pond DW3a: Prop. Drywell**

Inflow Area = 820 sf, 100.00% Impervious, Inflow Depth = 6.26" for 100-yr event  
 Inflow = 0.12 cfs @ 12.08 hrs, Volume= 428 cf  
 Outflow = 0.02 cfs @ 12.61 hrs, Volume= 273 cf, Atten= 87%, Lag= 31.6 min  
 Discarded = 0.00 cfs @ 6.93 hrs, Volume= 214 cf  
 Primary = 0.01 cfs @ 12.61 hrs, Volume= 60 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 73.01' @ 12.61 hrs Surf.Area= 96 sf Storage= 221 cf

Plug-Flow detention time= 332.3 min calculated for 273 cf (64% of inflow)

Center-of-Mass det. time= 226.4 min ( 970.4 - 744.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	66 cf	<b>7.67'W x 12.50'L x 3.50'H Prismatic</b> 336 cf Overall - 170 cf Embedded = 166 cf x 40.0% Voids
#2	69.00'	149 cf	<b>5.67'W x 10.50'L x 2.50'H Prismatic</b> Inside #1 170 cf Overall - 3.0" Wall Thickness = 149 cf
#3	71.50'	5 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> -Impervious
#4	73.00'	1,250 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) -Impervious
		1,470 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
73.00	2	0	0
73.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	68.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	73.00'	<b>20.0" Horiz. Orifice/Grate</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

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**Discarded OutFlow** Max=0.00 cfs @ 6.93 hrs HW=68.51' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.01 cfs @ 12.61 hrs HW=73.01' TW=63.23' (Dynamic Tailwater)↑**2=Orifice/Grate** (Weir Controls 0.01 cfs @ 0.30 fps)**Summary for Pond DW3b: Prop. Drywells**

Inflow Area = 1,640 sf, 100.00% Impervious, Inflow Depth = 6.26" for 100-yr event  
 Inflow = 0.24 cfs @ 12.08 hrs, Volume= 856 cf  
 Outflow = 0.03 cfs @ 12.66 hrs, Volume= 546 cf, Atten= 88%, Lag= 34.8 min  
 Discarded = 0.00 cfs @ 6.93 hrs, Volume= 427 cf  
 Primary = 0.02 cfs @ 12.66 hrs, Volume= 119 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Peak Elev= 72.01' @ 12.66 hrs Surf.Area= 192 sf Storage= 446 cf

Plug-Flow detention time= 332.8 min calculated for 546 cf (64% of inflow)  
 Center-of-Mass det. time= 226.9 min ( 970.9 - 744.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	67.50'	133 cf	<b>7.67'W x 12.50'L x 3.50'H Prismatic</b> x 2 671 cf Overall - 339 cf Embedded = 332 cf x 40.0% Voids
#2	68.00'	298 cf	<b>5.67'W x 10.50'L x 2.50'H Prismatic</b> x 2 Inside #1 339 cf Overall - 3.0" Wall Thickness = 298 cf
#3	70.50'	9 cf	<b>2.00'D x 1.50'H Vertical Cone/Cylinder</b> x 2 -Impervious
#4	72.00'	2,501 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) x 2 -Impervious
		2,940 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
72.00	2	0	0
72.25	10,000	1,250	1,250

Device	Routing	Invert	Outlet Devices
#1	Discarded	67.50'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	72.00'	<b>20.0" Horiz. Orifice/Grate X 2.00</b> C= 0.600 in 20.0" Grate Limited to weir flow at low heads

**Discarded OutFlow** Max=0.00 cfs @ 6.93 hrs HW=67.51' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.02 cfs @ 12.66 hrs HW=72.01' TW=0.00' (Dynamic Tailwater)↑**2=Orifice/Grate** (Weir Controls 0.02 cfs @ 0.37 fps)

**Summary for Pond WQS: Prop. - WQS**

Inflow Area = 35,683 sf, 65.22% Impervious, Inflow Depth = 5.31" for 100-yr event  
Inflow = 4.83 cfs @ 12.10 hrs, Volume= 15,775 cf  
Outflow = 4.83 cfs @ 12.11 hrs, Volume= 15,775 cf, Atten= 0%, Lag= 0.6 min  
Primary = 4.83 cfs @ 12.11 hrs, Volume= 15,775 cf

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Peak Elev= 76.13' @ 12.11 hrs

Flood Elev= 80.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	74.00'	<b>12.0" Round OUTFALL</b> L= 167.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 74.00' / 58.00' S= 0.0958 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

**Primary OutFlow** Max=4.82 cfs @ 12.11 hrs HW=76.13' TW=61.79' (Dynamic Tailwater)

↑**1=OUTFALL** (Inlet Controls 4.82 cfs @ 6.14 fps)



ATTACHMENT D  
SUBCATCHMENT PLAN





ATTACHMENT E

LONG TERM POLLUTION  
PREVENTION PLAN

## Long Term Pollution Prevention Plan

Standard #4 of the MA DEP Stormwater Management Handbook requires that a Long Term Pollution Prevention Plan (LTPPP) be prepared and incorporated into the long term operation and maintenance plan of the projects stormwater management system. The purpose of the LTPPP is to identify potential sources of pollution that may affect the quality of stormwater discharges and to describe suggested practices to reduce pollutants in stormwater discharges.

Good housekeeping practices - The subject property owners are to keep the site in a neat and orderly condition so that pollutants are not conveyed to the storm drainage system. Materials swept, blown or washed into the storm drains can decrease the system's effectiveness and could eventually be conveyed into the adjacent wetland resource area. Some examples of good housekeeping practices are pavement sweeping, litter control, contained outdoor waste and proper cigarette disposal, and protected material storage areas. The property owners should assign responsibilities to personnel to keep the site in a neat and orderly condition.

Provisions for storing materials and waste products inside or under cover – There are no exterior (un-covered) storage areas associated with the project site. The trash and waste program include a weekly curbside trash pickup. A trash disposal company hired by the city will pick up waste materials and properly dispose at a state approved disposal facility.

The stormwater drainage system has catchbasins with hooded outlets and deep sumps designed to capture and retain trash, debris, oils, and sediments. Downstream of the catchbasins but before the stormwater outfall near the wetland, a proprietary separator is installed to further intercept and trash, debris, oils, and sediments that might have entered the stormwater drainage system.

Requirements for routine inspections and maintenance of stormwater BMP's - Consistent with Standard 9 of the Massachusetts Stormwater Management Regulations, an Operation and Maintenance Plan has been provided in the Stormwater Management Report. The plan details routine inspection and maintenance of the stormwater BMP's along with associated record keeping forms.

Spill prevention and response plans – Sources of potential spill hazards include vehicle fluids and fuels, pesticides, paints, solvents, and liquid cleaning products. The majority of the spill hazards would likely occur within the building and would not enter the stormwater drainage system. However, there are spill hazards from vehicle fluids and fuels located outside of the buildings. These exterior spill hazards have the potential to enter the stormwater drainage system and are to be addressed as follows:

- 1) Spill hazards of pesticides, paints, and solvents shall be remediated using the Manufacturers' recommended spill cleanup protocol.
- 2) Vehicle fluid and fuel spills shall be remediated according to local and state regulations governing fuel spills.
- 3) The property owners shall have the following equipment and materials on hand to address a spill clean-up: brooms, dust-pans, mops, rags, gloves, trash bags, trash containers, and absorptive materials such as sand, sawdust, or kitty litter.
- 4) Spills of toxic or hazardous materials shall be reported to the Massachusetts Department of Environmental Protection at 1-888-304-1133.

Provisions for maintenance of lawns, garden, and other landscaped areas - It should be a general goal of the subject property owners to achieve a high quality of well-groomed and stable landscape that evolves throughout the changing seasons and overall condition of the property. All landscaped areas are to be maintained with dense vegetative growth or a layer of mulch so as to minimize sediment transport. Litter and waste is to be removed weekly from the landscaped areas and adjoining parking lots and disposed of properly.

Requirements for storage and use of fertilizer, herbicides, and pesticides - Fertilizers, herbicides, and pesticides are not to be stored on site or within the buildings. Should use of same become necessary, application should be performed by a state licensed contractor in accordance with the manufacturer's label instruction and when environmental conditions are conducive to product application. Chemical controls should be used as a last resort to organic and biological control methods.

Pet waste management provisions - All pet waste is to be scooped up, sealed in a plastic bag, and disposed of properly in the garbage. Never deposit pet waste in the stormwater management system for it contains high level of fecal coliform bacteria.

Provisions for operation and management of septic systems – There are no septic systems associated with the project site. The sanitary sewer is proposed to be connected to the town sewer main in Sunnycrest Avenue.

Snow disposal and deicing chemicals – The roadways are designed with 24 feet of pavement and minimum 8-foot wide grass reserve strip throughout. This should provide ample width to maintain reasonable travel lanes with snow cast along the edge of the roadway and reserve strip. Snow removal has generally not been necessary in newly-constructed residential subdivisions in Beverly in recent years, with the exception of limited clearing of snow banks at intersections to provide a path for adjoining sidewalks and to increase visibility. In these instances snow is usually moved less than 100 feet to a more convenient location. No snow is to be moved to within 100 feet of a wetland resource area.

The individual property owners will be responsible for the clearing of their individual driveways and building entrances. The owners may be required to use a de-icing agent such as salt or potassium chloride to maintain a safe walking surface. The de-icing agent for the walkways and building entrances may be kept on site within the building (i.e. garage). De-icing agents are not be stored outside.

ATTACHMENT F

OPERATION &  
MAINTENANCE  
PLAN



## Operation & Maintenance Plan

System Owner: PD Building LLC (or Successors)

Party Responsible for O&M: Following construction and acceptance of the roadway, drainage structures within the public right-of-way will be maintained by the City of Beverly. This includes the catchbasin, drain manholes, drain pipes, and stormwater treatment device. The infiltration basin and the drainage piping downstream of the stormwater treatment device will be the responsibility of the homeowner's association. The drywells on each lot will be maintained by the individual property owners.

*Note: The inspector should note that drainage pipes, manholes and catchbasins often are considered "confined spaces" subject to strict OSHA standards regarding safe entry. Confined spaces present inherent hazards to workers. Only appropriately trained staff with appropriate safety equipment and monitors may enter confined spaces, and then only with a specific entry permit. Also, this work may pose hazards to workers, such as soft ground, flowing or standing water, snakes and rodents. Again, only appropriately trained staff with the necessary safety equipment should undertake such work.*

The drainage system is to be operated and maintained in accordance with the following:

### **Part I: Construction Phase Controls**

**Roadway Construction Phasing:** Construction shall proceed in the following sequence:

1. Install Erosion Controls downhill of work areas and site Construction Entrance. Inspection and maintenance of these Erosion Controls and Construction Entrance is required throughout the project as detailed below.
2. Clear & Grub areas only as needed.
3. Install infiltration basin with outlet control structure and level spreader. Basin side slopes to be protected with erosion control blankets. Haybales and silt fence are also to be installed uphill of the basin to prevent sediment transport into the basin. Haybales to be maintained until the uphill area is stabilized.
4. Strip topsoil from roadway area and bring road alignment to rough subgrade.

5. Install all underground utilities.
6. Install road base, fine grade and install binder course of bituminous pavement. Install drainage grates, and protect with silt sacks.
7. Install curbing, tree belts, and grass strip.
8. Adjust gratings and the install final paving.

Throughout construction, siltation controls are to be placed at drain inlets to prevent silt from entering the drainage system. These controls are to be inspected daily and maintained throughout the duration of the construction phase, and removed only when needed to pave the surfaces. The siltation controls shall be maintained and sediment removed as needed throughout construction.

Prior to turning the roadway over to the City for acceptance, the site shall be in a stable condition. All catchbasins, drain manholes, and stormwater treatment devices shall be cleaned with a vacuum truck. The roadway shall be free of any debris and swept clean.

**Home Construction Phasing:** Construction shall proceed in the following sequence.

1. Install Erosion Controls downhill of work areas. Inspection and maintenance of these Erosion Controls is required throughout the project as detailed below.
2. Clear & Grub lots only as needed.
3. Install construction entrance (rip rap apron) along street line for construction vehicles entering and exiting
4. Excavate foundation hole. Install foundation and first floor deck.
5. Backfill around the foundation, install building utilities, and rough grade site. Construct structure.
6. Install driveway and landscaping

## **Part II: Post-Development Controls**

1). Inspections. The catchbasin, stormwater treatment device, and piping system are to be inspected by the System Owner during the first year of operation on a quarterly basis. The inspection frequency can be reduced after the first year to annual inspections provided that the quarterly inspections do not indicate the need for more frequent inspections. If more frequent inspections become appropriate at any time, they should be implemented. Inspection Forms are later provided.

*Piping System.* During each inspection the piping is to be inspected for structural integrity, settlement and sedimentation. Standing water in the piping indicates a lack of infiltration capacity or settlement. Sedimentation in the piping indicates the need for cleaning.

*Catchbasins.* Remove the cover from the catchbasin and visually inspect for corrosion and structural damage. Using a wooden pole, probe the sump to determine the depth of sediment. Accumulation greater than 16" indicates clean-out. Cleaning should be by a vacuum truck or clamshell. Take care as to not damage the catchbasin hood. If an oil layer is floating on the water surface, place an oil-absorbent pillow on surface, allow to soak and remove and replace. Repeat this process until the oil layer is removed. Alternatively, have the oil layer pumped out by a licensed disposal contractor and appropriately disposed of. The oil absorbent pillows must be drummed for disposal by a licensed disposal contractor.

*Roadway.* Remove debris from the roadway as it accumulates, as part of normal site clean-up. Weekly patrolling for litter is recommended. Sand from ice control should be removed monthly via a street sweeper during the winter season. Significant oil leaks should be swept up and disposed of using oil-absorbent material as they are discovered. Any oil spills or leaks that reach the catchbasins must be reported to the Massachusetts DEP oil spill hotline.

*Infiltration Basin.* The infiltration basin should be inspected at least twice per year for erosion, damage to the outlet structure, sediment accumulation around the outlet, subsidence, cracking or tree growth on the embankments. Inspect the pond outlet structure for evidence of clogging or discharge velocities that are greater than design flow. Repair the outlet structure if not plumb, or if drain holes have been damaged. Remove trash and debris from the pond. The side slopes and the bottoms should be mowed at least twice annually. Sediment should be removed when it exceeds 6-inches in depth. After an extended period of dry weather inspect for standing water. Remove silt from the rip rap areas as it accumulates.

*Recharge Structures.* Initially, inspect the drywell recharge structures after major storms to ensure proper function and stabilization. Record water levels over several days to check for the infiltration performance. After the first year, inspect the drywell recharge structures annually for silt buildup or clogging.

**TABLE 1: Construction Phase Inspection and Maintenance Procedures**

<b>Control</b>	<b>Inspection Frequency (1)</b>	<b>Maintenance Procedure</b>
Construction Entrance	Weekly	a
Silt Fence	Weekly	a
Rip Rap	Weekly	a
Detention Basins	Weekly	a
Dust Control	Daily	b
Permanent Stabilization	Weekly	c

1. Inspection frequencies are a minimum. Site conditions may warrant more frequent review. All control shall be inspected after each storm event which exceeds 0.5 inches in 24-hours.
2. Maintenance Procedures shall be reviewed and revised as necessary to protect the environment.
  - a. Remove accumulated debris and replace as necessary.
  - b. Water or calcium chloride shall be utilized to prevent the generation of dust.
  - c. Disturbed areas shall either be paved or stabilized by permanent seeding.

Inspection forms are to be completed weekly and retained with project files.

## INSPECTION AND MAINTENANCE REPORT FORM

TO BE COMPLETED EVERY 7 DAYS AND WITHIN 24 HOURS OF  
A RAINFALL EVENT OF 0.5 INCHES OR MORE

**INSPECTOR:** \_\_\_\_\_

**DATE:** \_\_\_\_\_

**INSPECTOR'S QUALIFICATIONS:**

\_\_\_\_\_

**DAYS SINCE LAST RAINFALL:** \_\_\_\_\_

**AMOUNT OF LAST RAINFALL:** \_\_\_\_\_ INCHES

### STABILIZATION MEASURES

Project Area	Date Since Last Disturbed	Date of Next Disturbance	Stabilized? (Yes/No)	Stabilized With	Condition
North					
East					
South					
West					

**STABILIZATION REQUIRED:**

\_\_\_\_\_

\_\_\_\_\_

**TO BE PERFORMED BY:** \_\_\_\_\_ **ON OR BEFORE** \_\_\_\_\_

## INSPECTION AND MAINTENANCE REPORT FORM

### STABILIZED CONSTRUCTION ENTRANCE

Does Sediment Get Tracked onto the Road?	Is the Gravel Clean or is it Filled with Sediment?	Does All Traffic Use the Stabilized Exit to Leave the Site?

MAINTENANCE REQUIRED FOR ENTRANCE:

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TO BE PERFORMED BY:\_\_\_\_\_ ON OR BEFORE\_\_

## INSPECTION AND MAINTENANCE REPORT FORM

### SILT FENCE or HAYBALES

Location	Depth of Sediment Build-Up	Sediment Need Removal?	Need Replacement?
Eastern Side			
Southern Side			
Western Side			
Northern Side			

MAINTENANCE REQUIRED FOR SWALE:

\_\_\_\_\_  
\_\_\_\_\_

TO BE PERFORMED BY: \_\_\_\_\_ ON OR BEFORE\_

## INSPECTION AND MAINTENANCE REPORT FORM

### DETENTION BASINS

Location	Depth of Sediment Build-Up	Sediment Need Removal?	Need Replacement?
#1			
#2			
#3			
#4			

MAINTENANCE REQUIRED FOR BASIN:

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TO BE PERFORMED BY: \_\_\_\_\_ ON OR BEFORE\_



## INSPECTION AND MAINTENANCE REPORT FORM

### DEEP SUMP CATCHBASINS / STORMWATER TREATMENT DEVICES

Location	Depth of Sediment Build-Up	Sediment Need Removal?	Need Replacement?

MAINTENANCE REQUIRED:

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TO BE PERFORMED BY: \_\_\_\_\_ ON OR BEFORE\_

ATTACHMENT G

ILLICIT DISCHARGE  
STATEMENT

## ILLICIT DISCHARGE COMPLIANCE STATEMENT

I verify that no illicit discharges exist from the Sunnycrest Circle residential subdivision. Through the implementation of Long Term Pollution Prevention Plan and Operation and Maintenance Plan, measures are set forth to prevent illicit discharges from entering the stormwater management drainage system.

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**Signature**

**Print Name**

**Date**

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**Title**

**Company**

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**Signature**

**Print Name**

**Date**

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**Title**

**Company**

Note: This certification must be signed before stormwater is conveyed to the proposed stormwater drainage system in accordance with Standard 10 of the Massachusetts Stormwater Management Standards.